Heating Piping & Air Conditioning

AUGUST 1956

INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

Journal Section of the American Society of Heating and Air-Conditioning Engineers—p. 117

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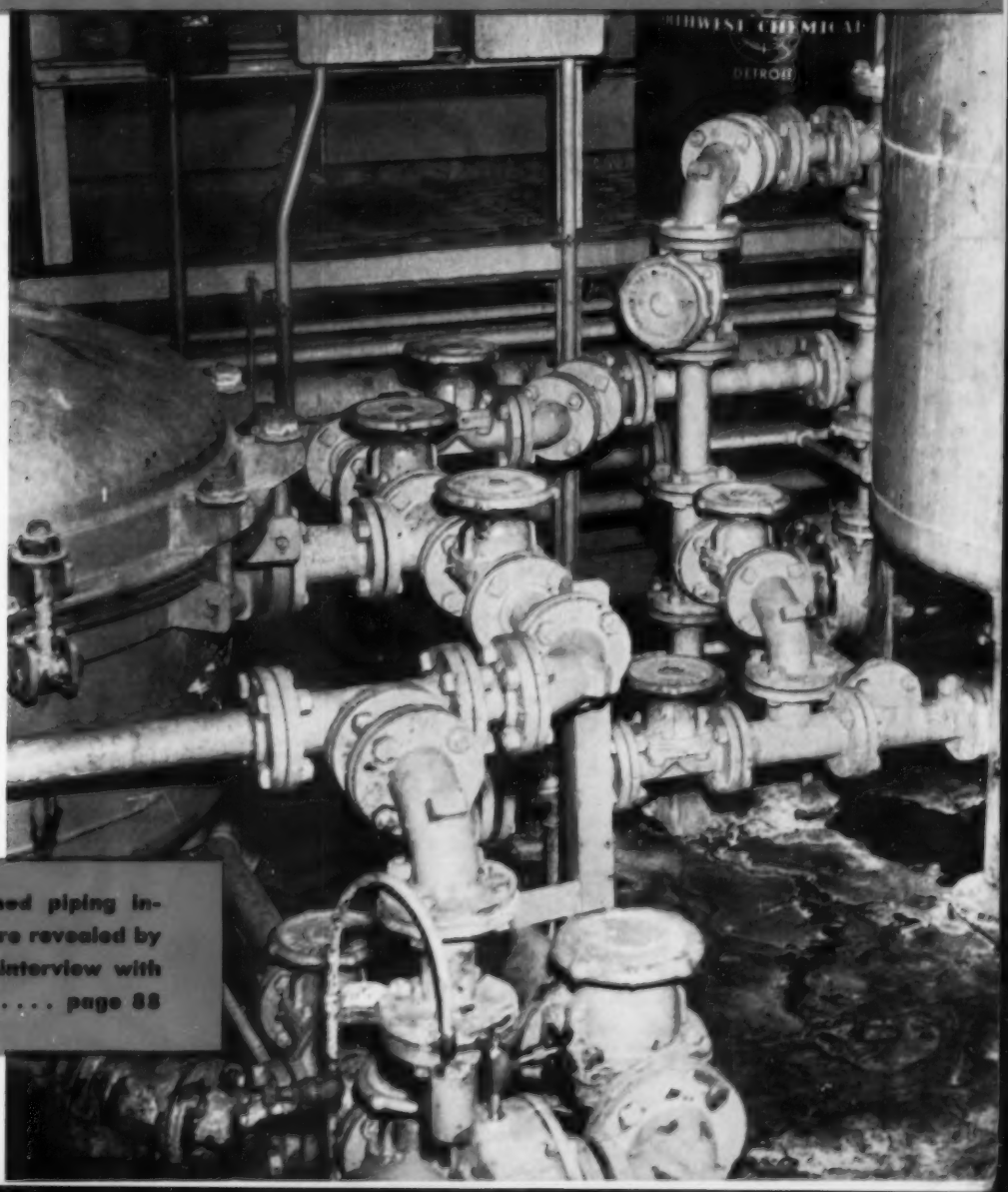


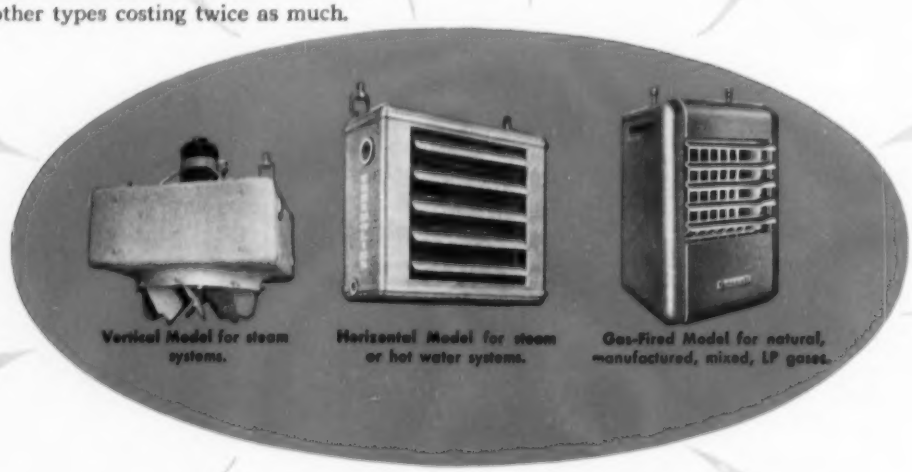
Plastic and plastic lined piping installation techniques are revealed by leading contractor in interview with HPAC ..... page 88

Remodeling?

Look to GRINNELL UNIT HEATERS

...for MAXIMUM comfort economy and flexibility

Grinnell Unit Heaters bring you many unique design and construction features, coupled with important advantages in comfort, economy, and ease of heating. Heat comes fast, even from a cold start — and is spread uniformly to all parts of the working area. It is not allowed to bank up uselessly under the ceiling. Units are compact. And, both unit and the simple piping are overhead, out of the way, easy to relocate if necessary. Heating capacity often exceeds that of other types costing twice as much.



Vertical Model for steam systems.

Horizontal Model for steam or hot water systems.

Gas-Fired Model for natural, manufactured, mixed, LP gases.

GRINNELL THERMOLIER
Steam/Hot Water Unit Heater
4 models . . . 18 sizes — from 35,600 to 275,300 total heat delivered, Btu per hour

Three basic models—horizontal, vertical, and a special horizontal Textile model. (Adjustable velocity nozzle also available for use on horizontal models.) All models have plain thermostatic trap, the simplest and least expensive kind of a trap, made practical because of unit's exclusive internal cooling leg; maximum capacity provided and destructive water hammer eliminated by built-in pitch of tubes. Many other important features.

GRINNELL
Gas-Fired Unit Heater
Available in 7 sizes — ranging from 25,000 to 200,000 Btu per hour input

Grinnell Gas-Fired Unit Heaters are easy to install, simple to operate and maintain. Efficient performance is assured — with any type of gas — by modern design of burners and heat exchanger, proper motor and fan unit. Automatic safety pilot operates to shut off main gas supply if pilot goes out. Flashback and extinction noise prevented by the burners' raised port design and proper port size for the gas used. American Gas Association approved.

Grinnell Unit Heaters are backed by over 60 years of heating experience, and proved by trouble-free service in countless installations. They are distributed by a coast-to-coast network of plumbing and heating jobbers . . . and in over 30 principal cities, Grinnell engineers can offer on-the-spot advice and help on your heating problems. For new buildings, or for modernizing existing heating systems, it makes good sense to call on Grinnell first — for the unit heater that will meet your specific needs.

AVAILABLE FROM YOUR LOCAL DISTRIBUTOR.

Grinnell Company, Inc., Providence, Rhode Island

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

TO THE RESCUE...

usAIRco installs 10 central station RK's totaling 390 h.p., at Piasecki Helicopter without business interruption!

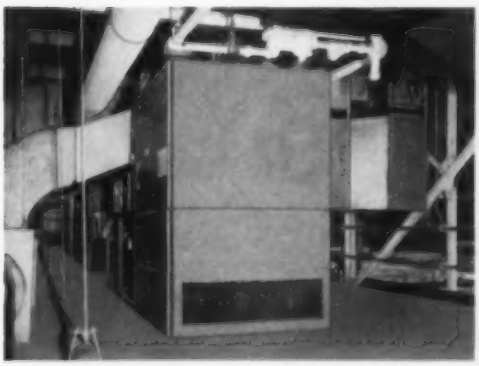
One of the largest integrated air conditioning systems ever installed using factory-assembled packaged central station equipment is in operation at the Piasecki Helicopter Corporation plant in Morton, Penn.

The conditioned area comprises approximately 70,000 square feet, divided into three large areas accommodating the plant's tool design, tool and equipment control, purchasing, accounting, engineering, drafting, cafeteria and reproduction departments.

Each usAIRco RK unit contains, in a single casing, all the elements of a central station packaged air conditioning plant, including built-in evaporative condenser for water recirculation.

The heat load in the conditioned space is unusually high due to low ceilings, virtually continuous lighting fixtures and the heavy concentration of personnel. The cooling season is approximately eight months per year, since heating is not required until outside air is 55 degrees F. or lower. Seven units are inoperative during the winter when existing space heaters, tied into the duct system, furnish fresh, tempered air. The three penthouse units, however, operate year-'round, with tempering accomplished by the use of conventional finned heating coils in the various branch ducts.

The system was designed by Charles S. Leopold, consulting engineer for the Piasecki Corporation, which was represented by W. F. Swartz, plant engineer, and J. E. Weber, plant facilities supervisor. The usAIRco representative is Malloy & Company, Paoli, Pennsylvania.



On a specially constructed concrete platform supported by steel gridwork are 7 usAIRco RK units. Conditioned air goes through wall, left, to ductwork above suspended ceiling in adjoining area.

Three usAIRco RK units are mounted in roof penthouses, shown here during construction. Supply air is delivered to nearby conditioned area through ducts. Units operate all year, with tempering through use of finned heating coils in branch ducts.

For further details, write C. I. Hawkinson

UNITED STATES AIR CONDITIONING CORPORATION

7900 Tabor Rd. Philadelphia 11, Pa. • Export: 13 E. 40th St., New York

usAIRco
10 YEARS OF AIR CONDITIONING

Wrought Iron Pipe's built-in protection . . . always "on guard" against corrosion

Wrought iron pipe's "armed guard" against corrosion is a concentration of thousands of glass-like iron silicate fibers distributed throughout the metal.

These iron silicate fibers are relatively immune to corrosion . . . so any attacks by corrosion are evenly dispersed over the entire surface of the metal. As a result of this built-in protection, deep pitting and penetration are repelled . . . costly premature repairs and maintenance are eliminated.

Our booklet, "The ABC's of Wrought Iron" tells more of this story. You'll find it profitable reading. Write for your copy today.

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Available in Canada and throughout the world.

BYERS *Wrought Iron Tubular and Hot Rolled Products*

ALSO ELECTRIC FURNACE QUALITY STEEL PRODUCTS

Heating Piping & Air Conditioning

Vol. 28 No. 8

AUGUST 1956

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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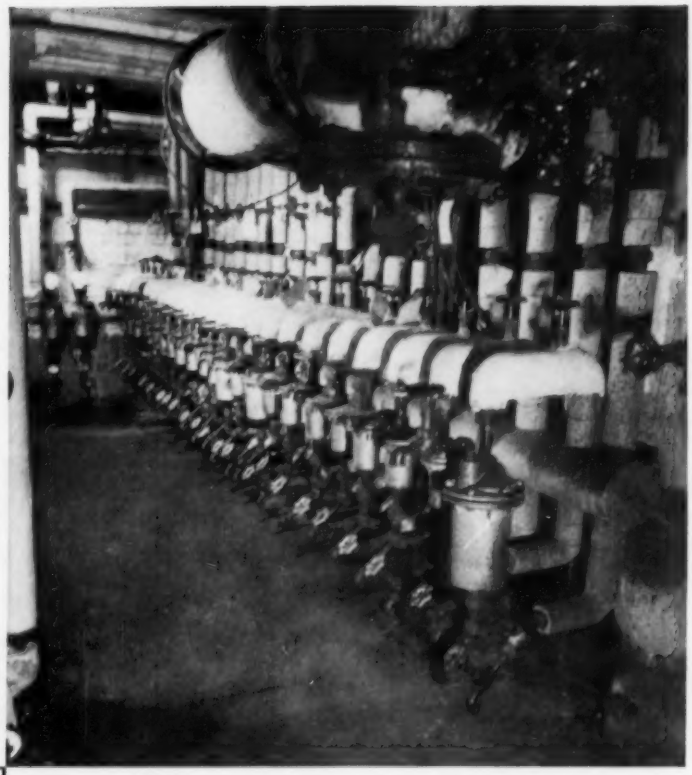
How Steam Trap Standardization *reduces Installation and Maintenance Work and Cost*



No Bypasses Needed. Traps can be replaced in a couple of minutes by uncoupling the unions and installing a "spare" trap complete with proper length pipe connections and half unions.

ORIFICE SIZES	
PRESSURE	SIZE
0-40	7/32
40-60	3/16
60-150	5/32

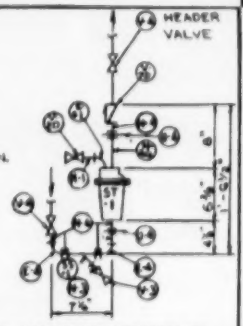
CAPACITY-0-300#/HR

NOTES:

DIMENSIONS SHOWN ARE FOR MINIMUM SPACE INSTALLATION.

IN LONG RUNS - PIPE TO BE PITCHED TOWARD TRAP.

TRAP TO BE INSTALLED BELOW DRAIN POINT IF POSSIBLE. IF NOT POSSIBLE, A CHECK VALVE MUST BE INSTALLED ON INLET SIDE OF TRAP.



BILL OF MATERIAL FOR TYPICAL STEAM TRAP HOOK-UP

MARK	REQD	MAT'L	DESCRIPTION
ST-1	1	STEEL BODY	½" STEAM TRAP - ARMSTRONG #211
SS-1	1	BRZ	½" STRAINER - 250# W.S.P. - [redacted]
V-4	2	BRZ	½" GATE VALVE - SCRD - 200# W.S.P. - [redacted]
V-20	1	BRZ	½" GLOBE VALVE - SCRD - 200# W.S.P. [redacted]
V-3	1	BRZ	½" GATE VALVE - SCRD - 200# W.S.P. - [redacted]
V-70	1	BRZ	½" CHECK VALVE - SCRD - 200# W.S.P. - [redacted]
E-4	2	MALL. IRON	½" 90° SCRD ELL - 2000# [redacted]
L-41	1	MALL. IRON	½" 90° STREET ELL - 3000# - [redacted]
U-4	2	MALL. IRON	½" UNION - 2000# - [redacted]
N-1	1	STL	½" SHORT NIPPLE - SCH 80 - SEAMLESS ASTM A-53
N-3	1	STL	½" SHORT NIPPLE - SCH 80 - SEAMLESS ASTM A-53
N-4	6	STL	½" SHORT NIPPLE - SCH 80 - SEAMLESS ASTM A-53
N 4/4	1	STL	½" - 4" LG NIPPLE - SCH 80 - SEAMLESS ASTM A-53

Trap Maintenance Costs Reduced $25,000 per Year with Armstrongs

Major reductions in steam trap installation and maintenance work and cost can be achieved by standardization on one make of trap which, in turn, permits standardized hookups. A major chemical company reports an annual maintenance saving of $25,000 since installing 4000 Armstrong traps according to the drawing and photograph shown here. Additionally, trap parts inventory is reduced and purchasing is simplified.

Traps of a Size Interchangeable. Note that exact dimensions are given for the pipe fittings, including nipples connected to each size of trap. When a trap needs repair, the unions can be uncoupled, the trap lifted from the line, and a "spare" carrying identical pipe connections slipped in place. In as little as one or two minutes, a faulty trap is replaced. It is then repaired and takes its place as a "spare".

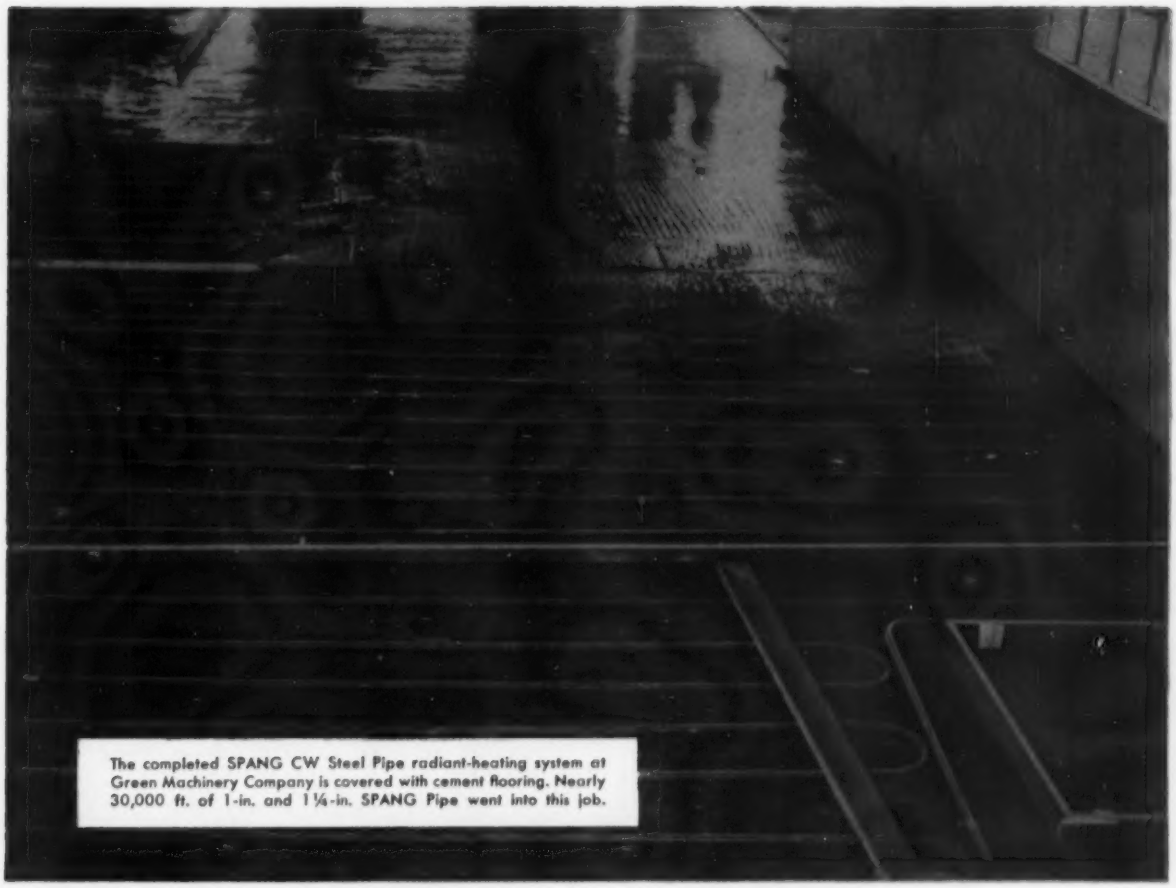
$25,000 Trap Maintenance Saving. Records on the Armstrong trap installation described here show that the cost of repair parts was approximately $10,000 less annually than with the traps previously used. Reduction in maintenance labor brings the total saving to $25,000, per year. *And, fuel savings attributable to the traps are at least equal to the maintenance saving.*

▲ *Standardized hookup* includes test valve for trap testing, strainer, blowdown valve for cleaning trap, shut-off valves and unions for quick replacement.

FOR COMPLETE INFORMATION on the traps that slash maintenance costs ask for the Armstrong Steam Trap Book containing complete data plus selection, installation and maintenance recommendations. Call your local Armstrong Representative or write.

ARMSTRONG MACHINE WORKS, 874 Maple Street • Three Rivers, Michigan

ARMSTRONG STEAM TRAPS



The completed SPANG CW Steel Pipe radiant-heating system at Green Machinery Company is covered with cement flooring. Nearly 30,000 ft. of 1-in. and 1¼-in. SPANG Pipe went into this job.

Another steel pipe radiant-heating system . . . installed with SPANG CW!

All three of Green Machinery Company's new buildings at Plainview, Texas, are warmed by a SPANG CW Steel Pipe radiant-heating system. Buried in the concrete floor, the pipe grids distribute an even, thermostat-controlled heat throughout the buildings where the famous Green Pumps and other irrigation equipment are manufactured. A 25 hp boiler serves the radiant-heating system.

Easy installation

SPANG CW Steel pipe's *quality-controlled* manufacturing provides easy, time-saving installations. SPANG CW is uniform throughout, has a strong weld, is easy to cut, bend, thread and weld. That's why it's preferred by plumbing and heating contractors everywhere for practically every type of installation.

Long service life

Quality-control processing builds long years of service into every foot of SPANG CW Steel Pipe. Careful attention to temperatures, forming and welding pressures produce in SPANG CW that extra quality that means extra service on the job. Testing and inspection eliminate any pipe that does not meet SPANG's high standards.

Buy it and try it!

Prove to yourself how easy SPANG CW Steel Pipe is to work with . . . how it can save you installation time! See your nearby SPANG Distributor for your next pipe order.

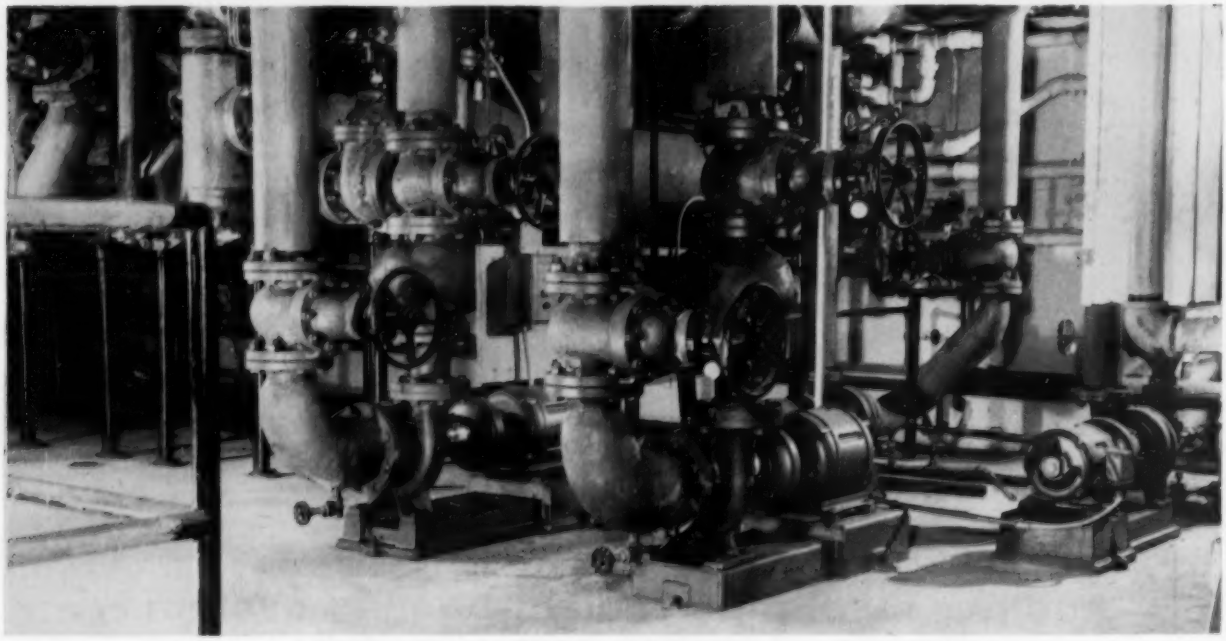
SPANG-CHALFANT
DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Offices: Two Gateway Center, Pittsburgh, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis

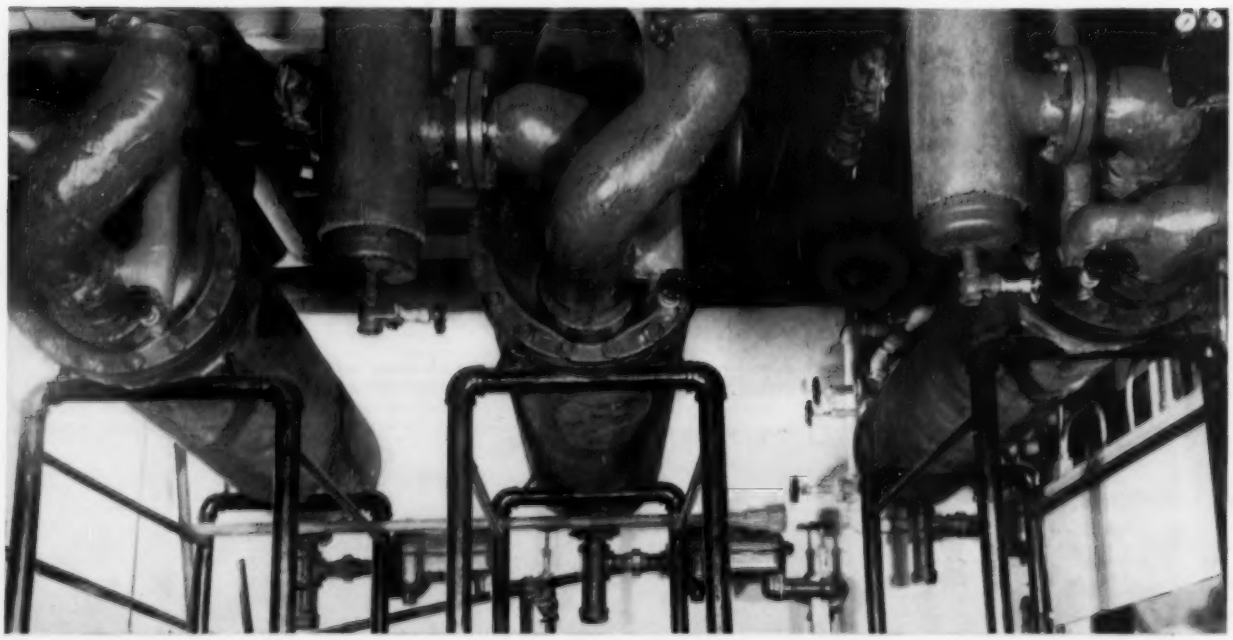
SPANG CW STEEL PIPE

Green Machinery's new main building includes offices, engine shop, assembly department, testing laboratory and stock room. Other two buildings house welding shop and storage rooms. All are heated by a SPANG radiant-heating system.

Notre Dame High School, Niles, Illinois



(above) *Battery of B&G Universal Pumps circulate a two-pipe, reverse return hot water heating system.*
(below) *Water is heated in these B&G "SU" Convertors connected to two low pressure boilers.*



Gymnasium, Notre Dame High School

B&G *Hydro-Flo* equipment matches modern design with the best in modern heating

Owners: **Holy Cross Fathers, South Bend, Ind.**

Architects: **Belli and Belli, Chicago, Illinois**

Heating Contractor: **Wm. A. Pope, Chicago, Illinois**

Construction Engineers: **W. B. Engineering Co., Chicago, Ill.**

B&G HYDRO-FLO EQUIPMENT USED

Five Universal Pumps
Nine Booster Pumps
Three "SU" Steam Convertors
Flo-Control Valves, Relief Valves
Expansion Tanks

In this modern high school, B&G *Hydro-Flo* Forced Hot Water Heating demonstrates its versatility in satisfying a variety of heating requirements.

Classrooms are heated with hot water unit ventilators, which supply a controlled combination of radiant heat, warmed air and fresh air. The unit ventilators are suspended in a fresh air tunnel beneath the corridors. Air passes through the ventilators and under the classroom floors to windowsill grilles. Each classroom has individual thermostatic control.

The uniquely designed gymnasium with cantilever-type roof is warmed with unit heaters, recessed and wall-mounted cabinet heaters. Radiant panels are used to heat the stage and shower room.

B&G Engineers are always available for consultation on the use of Bell & Gossett *Hydro-Flo* equipment.

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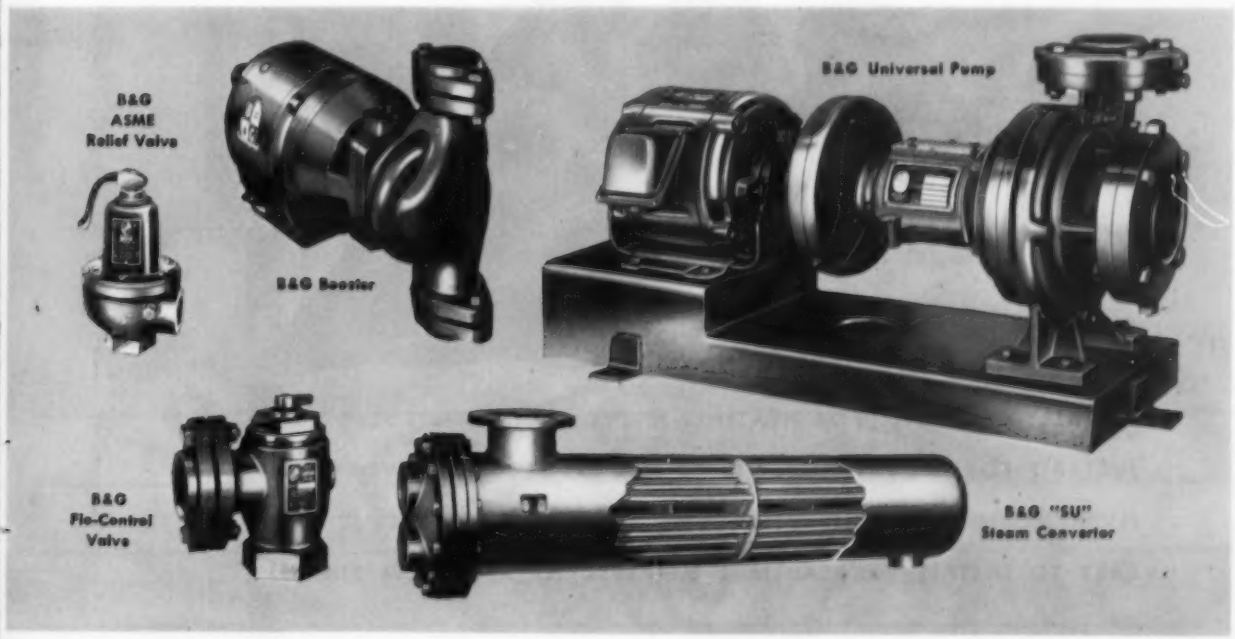

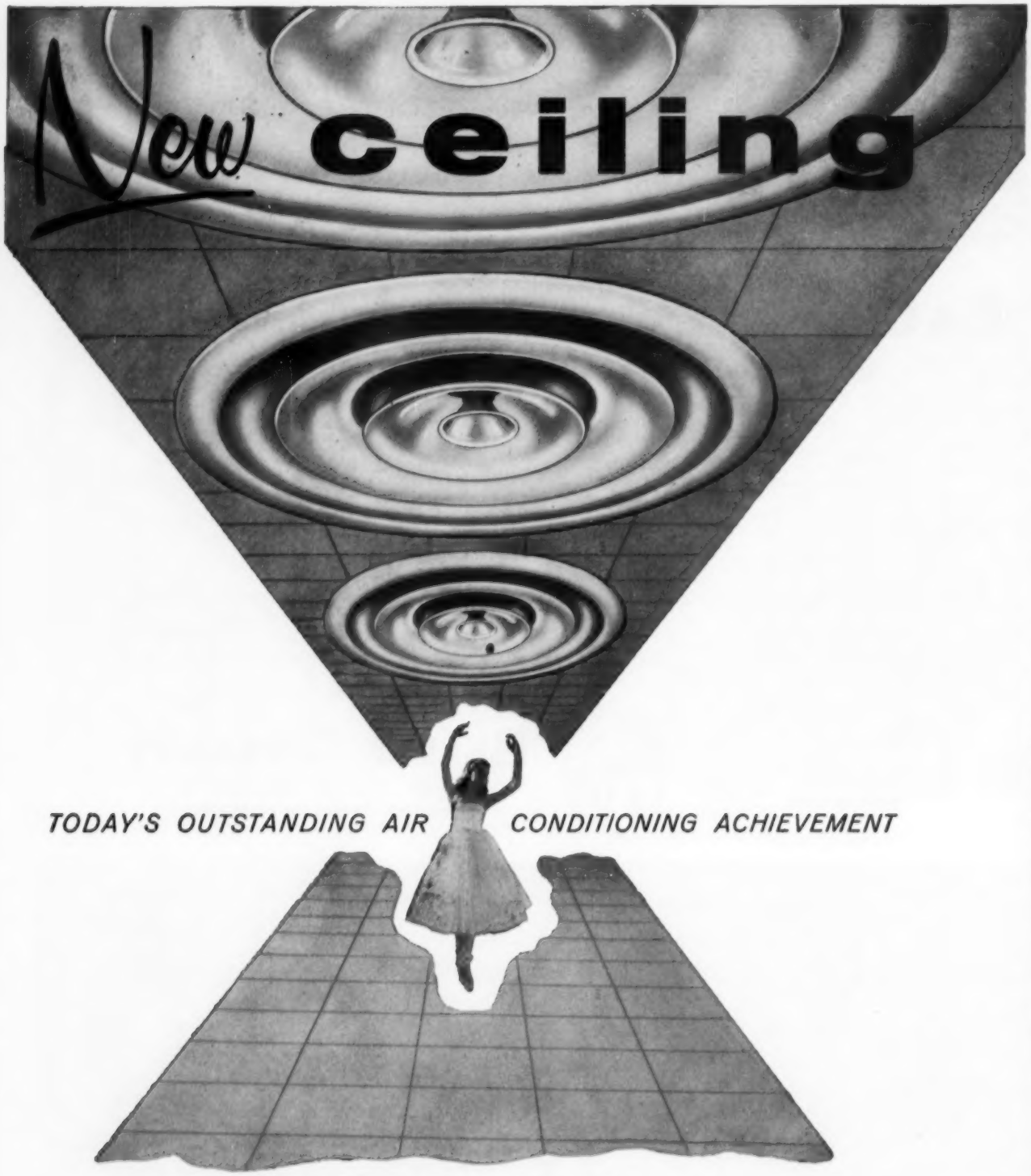

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diffusers

designed by TITUS

Here—beyond doubt—is America's most attractive, most *exciting* new line of ceiling diffusers! *Exciting* because of ultra modern styling that brings to any room a dignified "room of tomorrow" appearance... *Exciting* because of a new air control design that provides superior air diffusion performance.

Titus' new exclusive CURVED CONTOUR cone design—plus extreme adjustability—makes these outstanding precision air diffusion outlets EQUALLY EFFICIENT WHEN HANDLING EITHER COOLED OR HEATED AIR.

Extra simple to install. Save time and labor. Easiest in the world to adjust to any air pattern—before or after installation—without changing relative position of three center cones. Available in fixed cone and fully adjustable models, in all sizes... at truly realistic prices.

Also a complete new line of Titus designed, Titus engineered accessories—including ceiling cones and radial volume control dampers.

Write today—learn how this amazing new line of ceiling diffusers can offer you new stimulating design opportunities—and save you money on every overhead installation.

FOR HANDLING OVERHEAD AIR Gracefully WITH PRECISION

MAIL COUPON FOR NEW FREE CATALOG

TITUS MANUFACTURING CORP., WATERLOO, IOWA

Gentlemen: I am interested in complete information on your *exciting new line* of CEILING DIFFUSERS AND ACCESSORIES. Rush me NEW FREE CATALOG.

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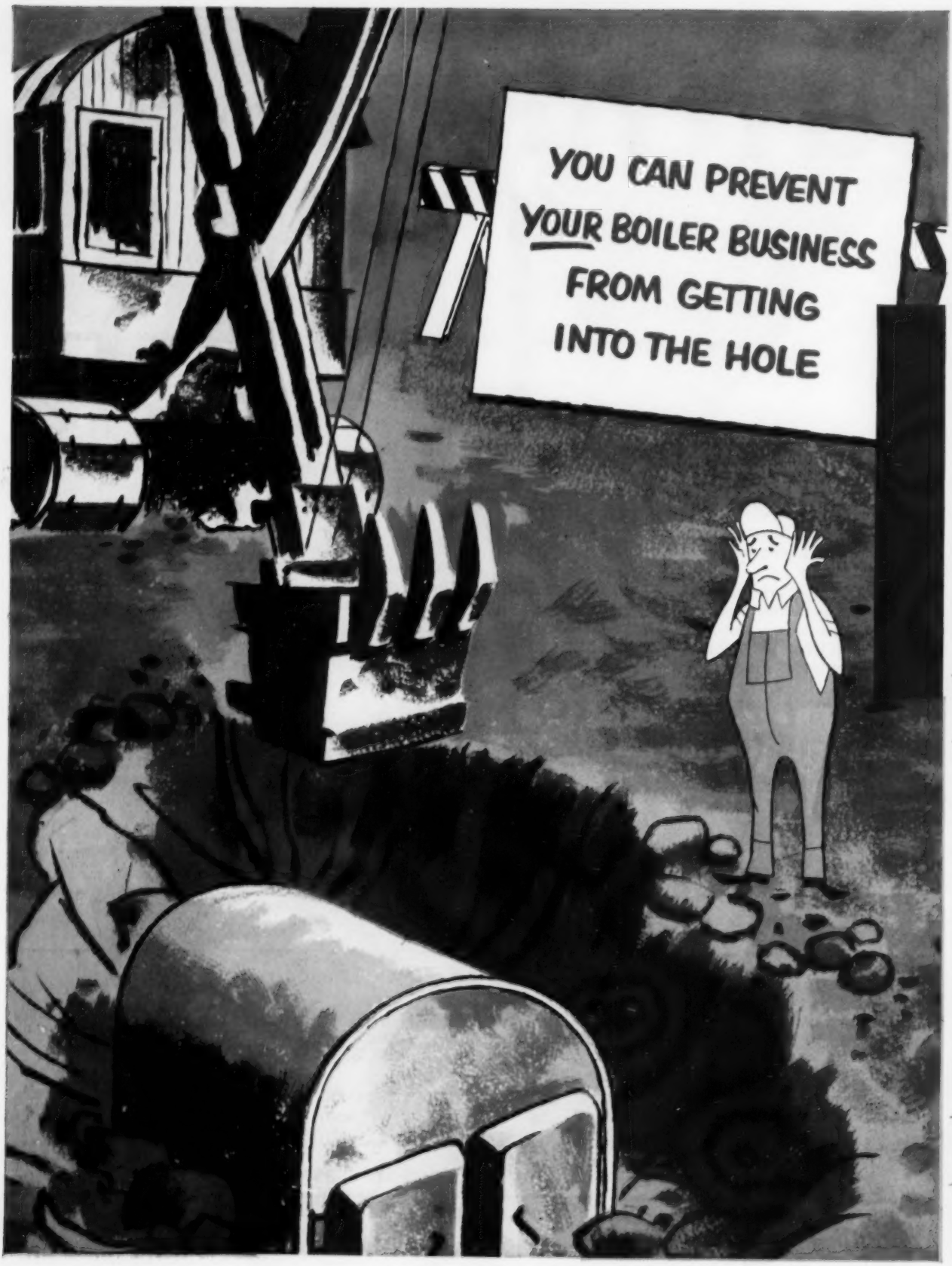

YOU CAN PREVENT
YOUR BOILER BUSINESS
FROM GETTING
INTO THE HOLE

Here's a real product advantage that will enable you to land more installations on new construction than ever before. Show the builder that he can save the cost of digging the pit required for conventional commercial boilers . . .

install the unique

SPENCER "LW"

Lower waterline—over-all height of the Spencer "LW" is approximately 25% less than conventional firebox boilers . . . saves excavation costs in new buildings by eliminating pit usually required.

Built in two sections—in existing buildings, divided design permits entry through narrow basement openings without tearing out walls. The two watertight sections are moved in separately with no welding for installation.

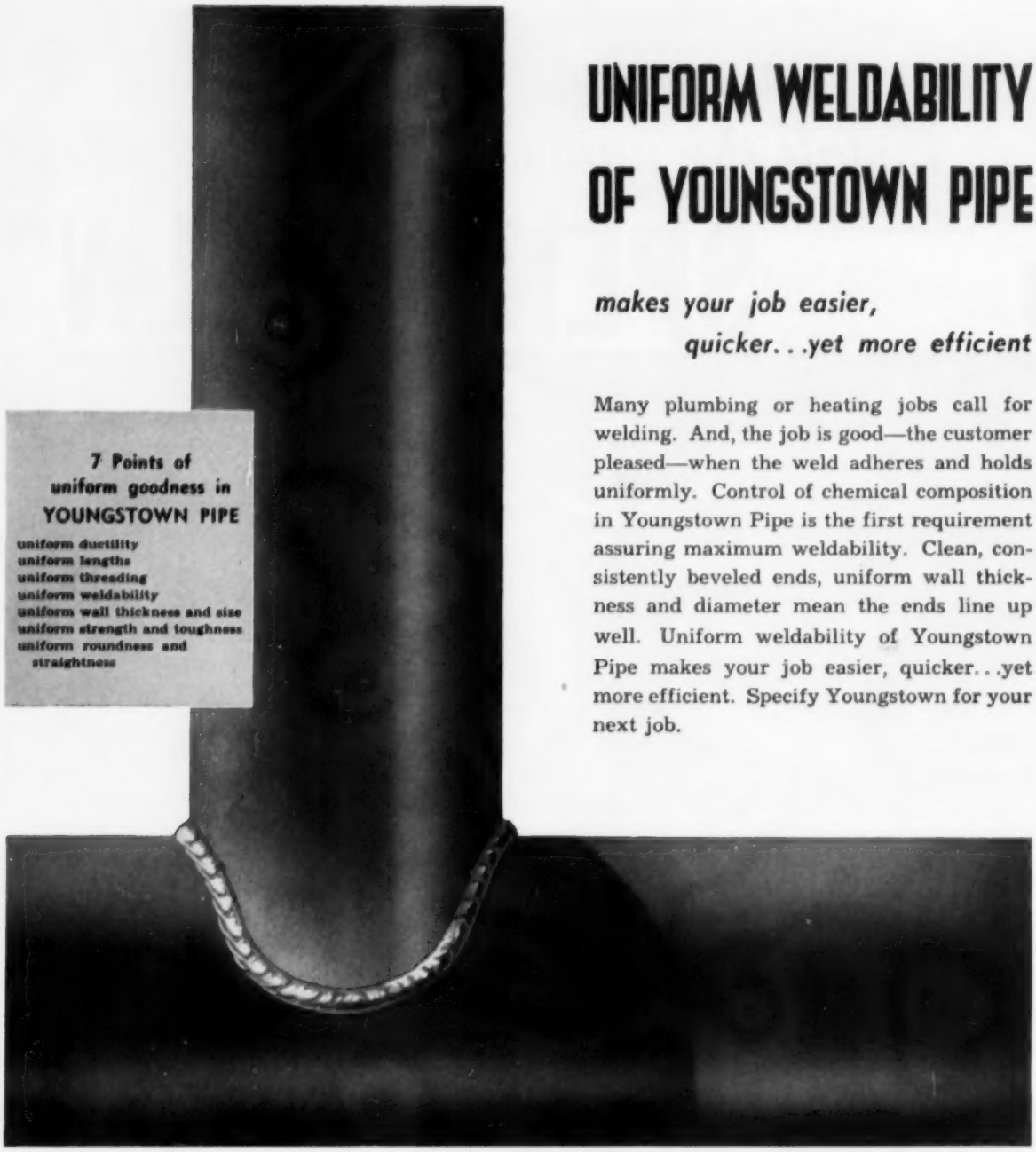
Let Spencer build up your boiler business—write Dept. HP-86

New Spencer "C." Heavy-duty commercial boiler performance at a residential boiler price! Can be fired with oil, gas or coal.

Spencer "A." Complete range of sizes from 3,500 to 50,000 sq. ft. steam, net SBI ratings. For *every* building . . . for *every* fuel.

SPENCER
HEATER
LYCOMING DIVISION
WILLIAMSPORT AVCO PENNSYLVANIA

ASME and SBI Approved SBI



7 Points of uniform goodness in YOUNGSTOWN PIPE

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

UNIFORM WELDABILITY OF YOUNGSTOWN PIPE

makes your job easier, quicker. . .yet more efficient

Many plumbing or heating jobs call for welding. And, the job is good—the customer pleased—when the weld adheres and holds uniformly. Control of chemical composition in Youngstown Pipe is the first requirement assuring maximum weldability. Clean, consistently beveled ends, uniform wall thickness and diameter mean the ends line up well. Uniform weldability of Youngstown Pipe makes your job easier, quicker. . .yet more efficient. Specify Youngstown for your next job.

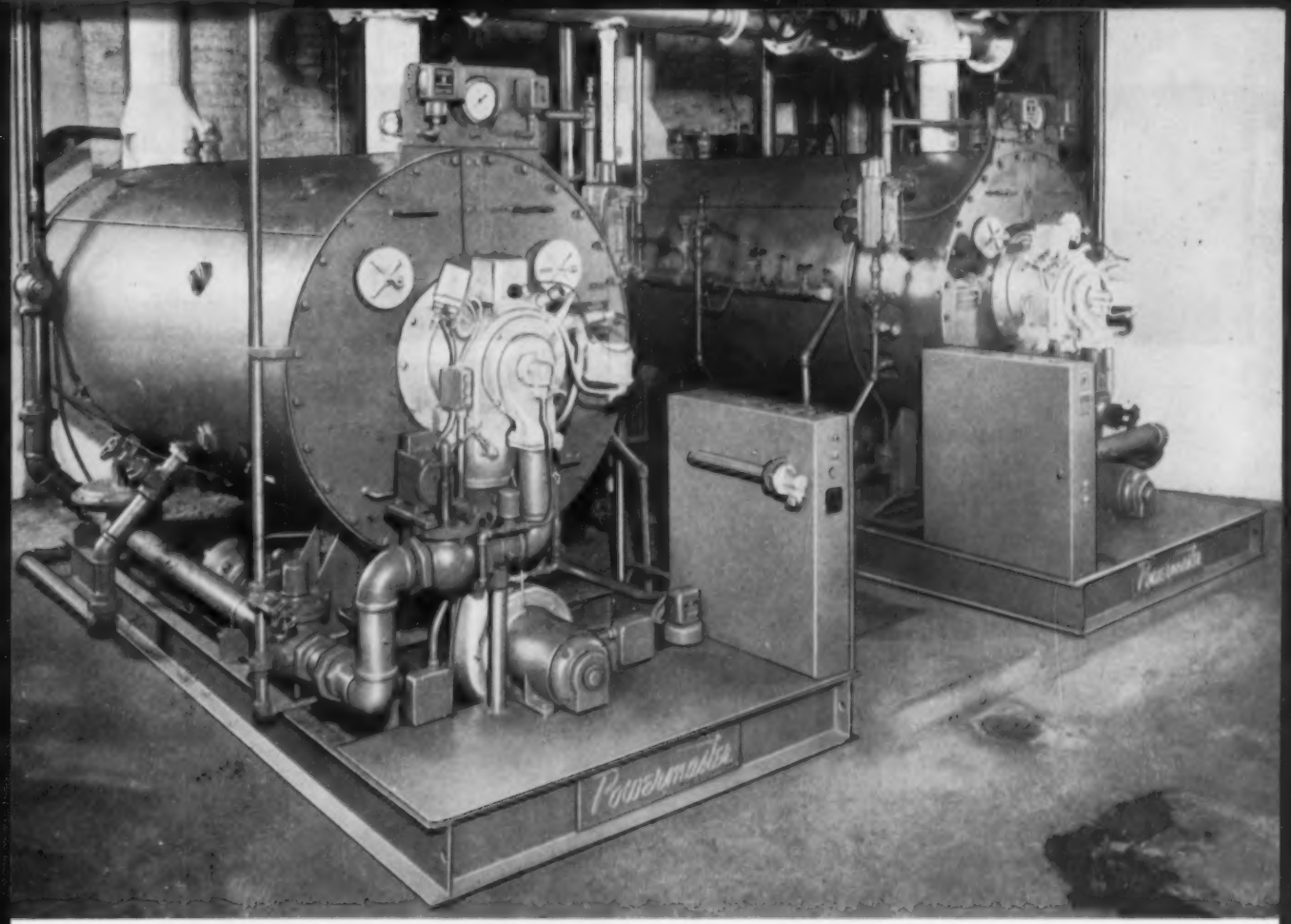
Youngstown PIPE

QUALITY YOUNGSTOWN SERVICE

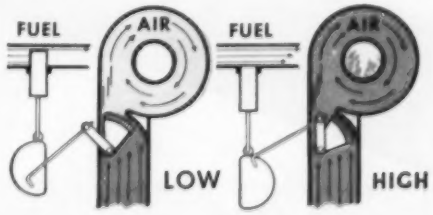
THE YOUNGSTOWN SHEET AND TUBE COMPANY Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices Youngstown, Ohio District Sales Offices in Principal Cities

SHEETS · STRIP · PLATES · STANDARD PIPE · LINE PIPE · OIL COUNTRY TUBULAR GOODS · CONDUIT AND EMT · MECHANICAL TUBING · COLD FINISHED BARS · HOT ROLLED BARS · WIRE · HOT ROLLED RODS · COKE TIN PLATE · ELECTROLYTIC TIN PLATE · BLACK PLATE · RAILROAD TRACK SPIKES · MINE ROOF BOLTS



Why *Powermaster*® users come back for more!



Infinitely Variable Combustion Modulation

automatically maintains proper fuel-air ratio at the burner for most efficient firing at all loads. Instant response of this *Powermaster* firing control to load swings from 20% to 100% of firing rate saves fuel and assures constant steam pressure and temperatures.

Cost-saving, trouble-free performance of *Powermaster* Packaged Automatic Boilers in several multi-story plant buildings of a Mid-West implement equipment manufacturer led to repeated purchases as more steam capacity was needed. A large number of other *Powermaster* users also have bought additional units—again and again. That's because *Powermaster* has the features and advantages that spell out operating satisfaction—and savings—for all kinds of industries, buildings and service establishments. You can get the benefit of *Powermaster* performance and economy through Orr & Sembower's Pay-As-You-SAVE Purchase Plan. Why not call in our representative to explain why *Powermaster* is a money-saving boiler investment for modernization or new steam requirements. Be sure to send for latest bulletin.

Powermaster®

PACKAGED AUTOMATIC BOILERS

Sizes to 500 HP; pressures to 250 psi

ORR & SEMBOWER, INC.

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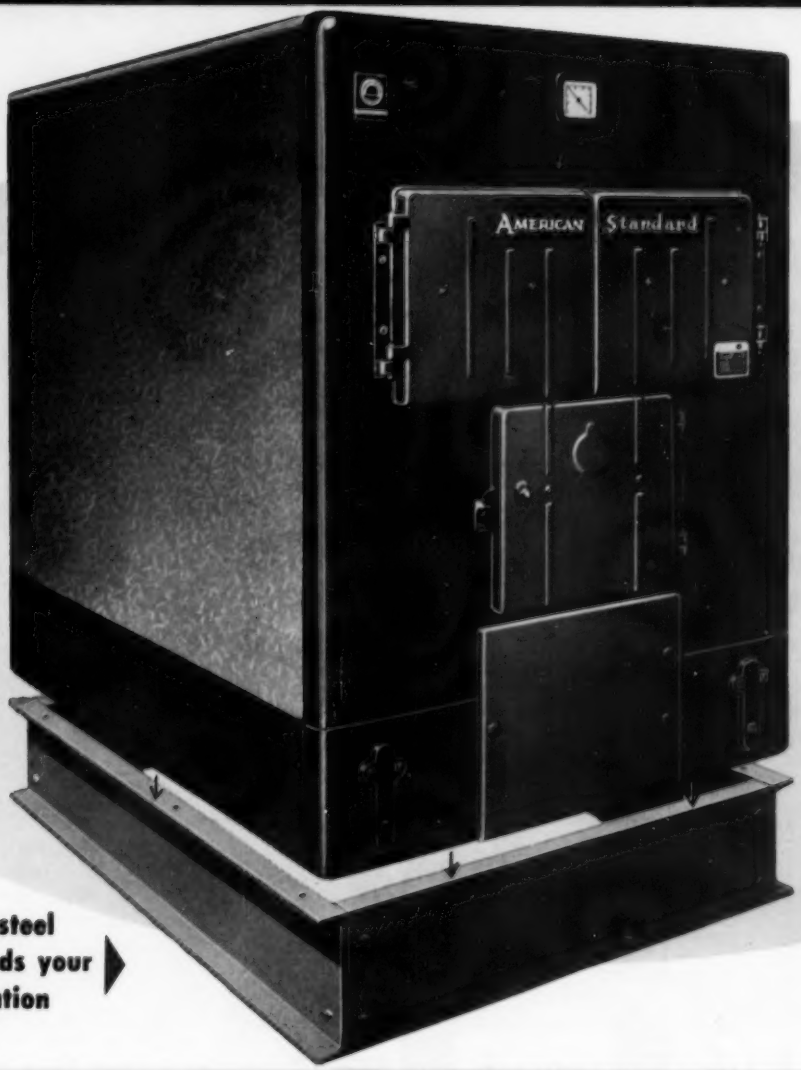
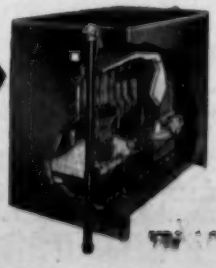
Introducing– The new, A-7 Cast Iron Boiler



Exclusive, new steel pedestal base speeds your heating installation

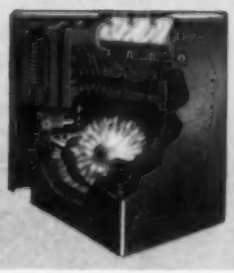
CAST TO LAST—CAST IRON BOILERS BY AMERICAN-Standard

G-4 gas-fired boiler—4 to 12 sections—only 47½" high—factory-assembled manifold permits fast, easy installation.



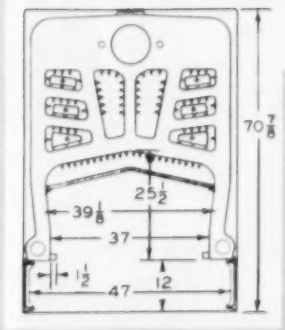
G-6 gas-fired boiler—for large buildings—cast iron base permits fast, low-cost installation—durable cast iron sections assure service—all major components under jacket enclosure.

Oakmont oil-fired heating unit—commercial and residential application—sturdy cast iron sections—Heat Lib-O-Rator, factory-moulded refractory combustion chamber—Arcoflame oil burner.



compact AMERICAN-Standard ... for all fuels

Exclusive STEEL PEDESTAL BASE ELIMINATES FLOOR PIT AND FIRE-BRICK BASE — BOLTS TOGETHER QUICKLY AND EASILY — CUTS YOUR INSTALLATION TIME AND COST



Added exclusive feature—upward and outward design of waterways, plus high water level, assures proper and continuous water flow; prevents lag in waterways, assures quick, smooth steaming.

PLUS—*these important features:*

- Sections of rugged, heavy-duty cast iron – factory-tested at 2½ times normal operating pressure.
- Eight practical sizes – 5 to 12 cast iron sections.
- Performance range of 2,630 to 6,380 sq. ft. net steam rating – 4,345 to 10,205 sq. ft. net water rating.
- Output from 869 Mbh to 1,972 Mbh.
- Compact, lightweight design facilitates handling.
- Designed for external-type domestic water heater.
- Special fin arrangement on sections provides maximum heating surface.

See your local American-Standard distributor today — or write for more information on the A-7 and other American-Standard heating products to AMERICAN-STANDARD, PLUMBING & HEATING DIVISION, 39 West 39th Street, New York 18, N. Y.

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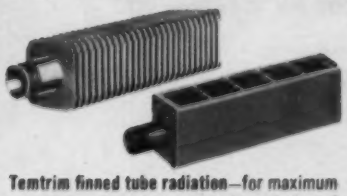
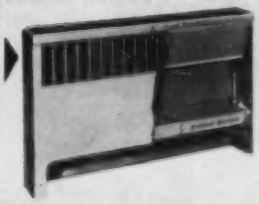
AMERICAN-Standard radiation means simple installation at low cost

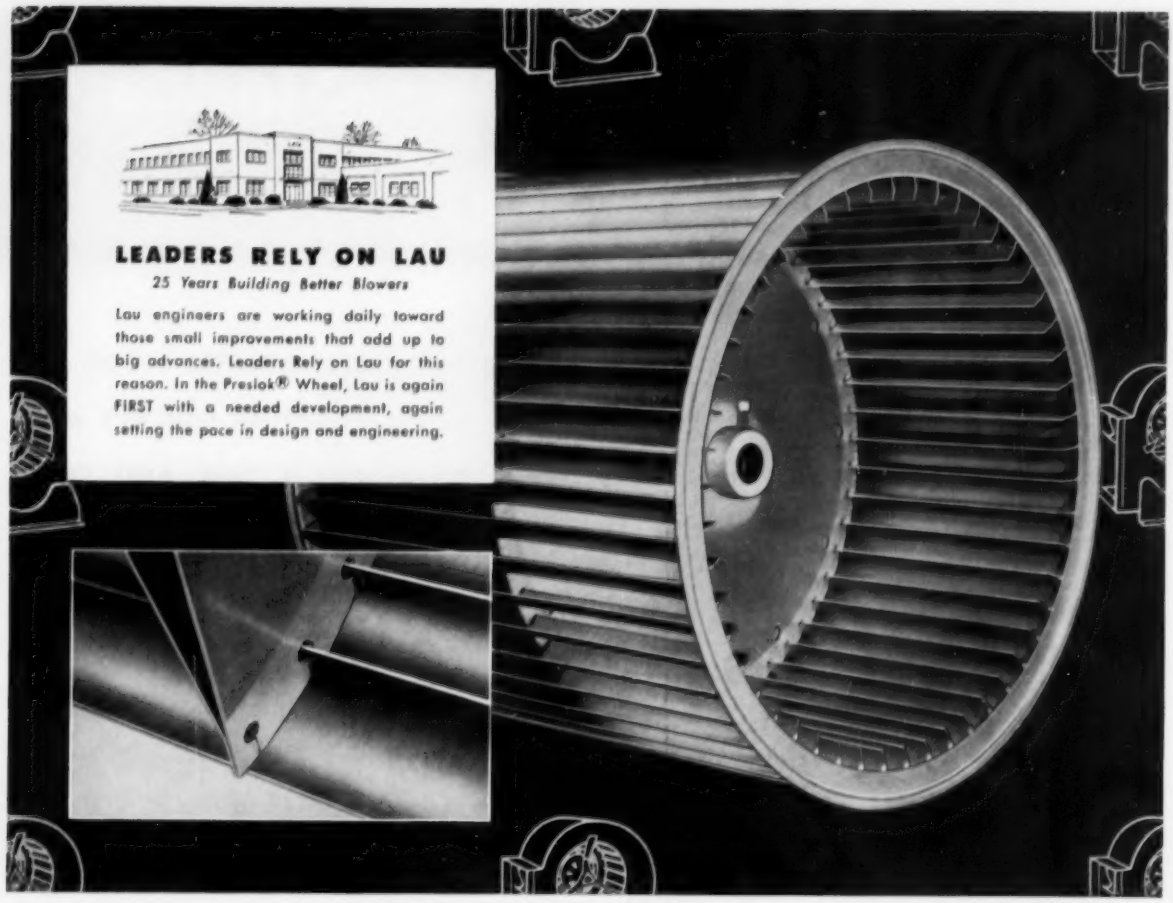


Temtrim finned tube radiation—for maximum economy . . . install exposed or choice of three smart covers (flat-top cover pictured).

Multifin Convector—quality-built non-ferrous convector—stock and special service models for all heating requirements.



Sunrad Radiator—cast iron radiator—recessed or free standing installation saves space—gives high output. Two convenient depths and heights—5" and 7⅛" deep, 20" and 23" high.



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25 Years Building Better Blowers

Lau engineers are working daily toward those small improvements that add up to big advances. Leaders Rely on Lau for this reason. In the Preslok® Wheel, Lau is again FIRST with a needed development, again setting the pace in design and engineering.

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THE LAU BLOWER COMPANY

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Answer to the need for higher speeds in modern air-conditioning equipment. *It is guaranteed to increase operating speed maximums at least 50%!* Yet, Preslok® Wheel is completely interchangeable with respect to air delivery, static pressure and horsepower input with standard Series "A" wheel. Each blade is *mechanically attached* to center disc, held by 4 individual steel fingers individually pressed within the blade. Further, ⅜" has been added to end ring for more rigidity and to bear the stresses of higher speeds. Center disc redesigned to include new airflow shape for smoother air patterns; additional ¾" spread of hubs adds stabilization to shaft. All sizes in full and ¾" width from A-9 through A-15; retooling in process to equip all Series "A", Econo-Pak® and Electro-Wheel® units. Lau also manufactures weld wheels and riveted wheels—1¾" to 30" width, 4¼" to 30" diameter; capacity range: 50 to 22,000 cfm, 0 to 2 s.p.

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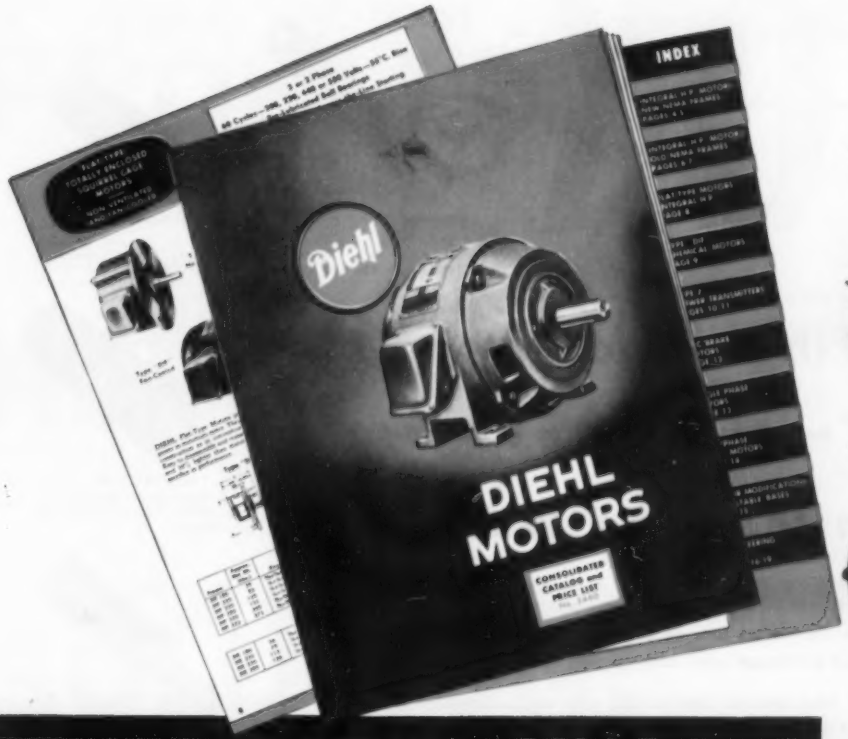
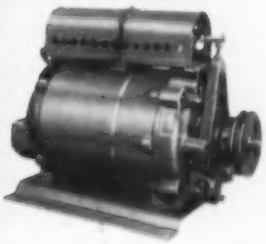


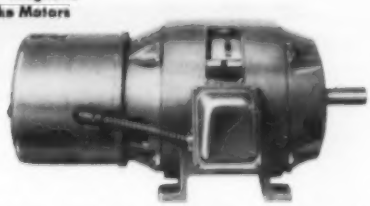
Type "DIE" Totally Enclosed Motors (Non-Ventilated)

Type "DIF" Totally Enclosed Motors (Fan Cooled)

Type "J" Power Transmitters with solenoid



Type "DI" Magnetic Disc Brake Motors



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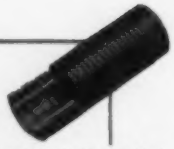

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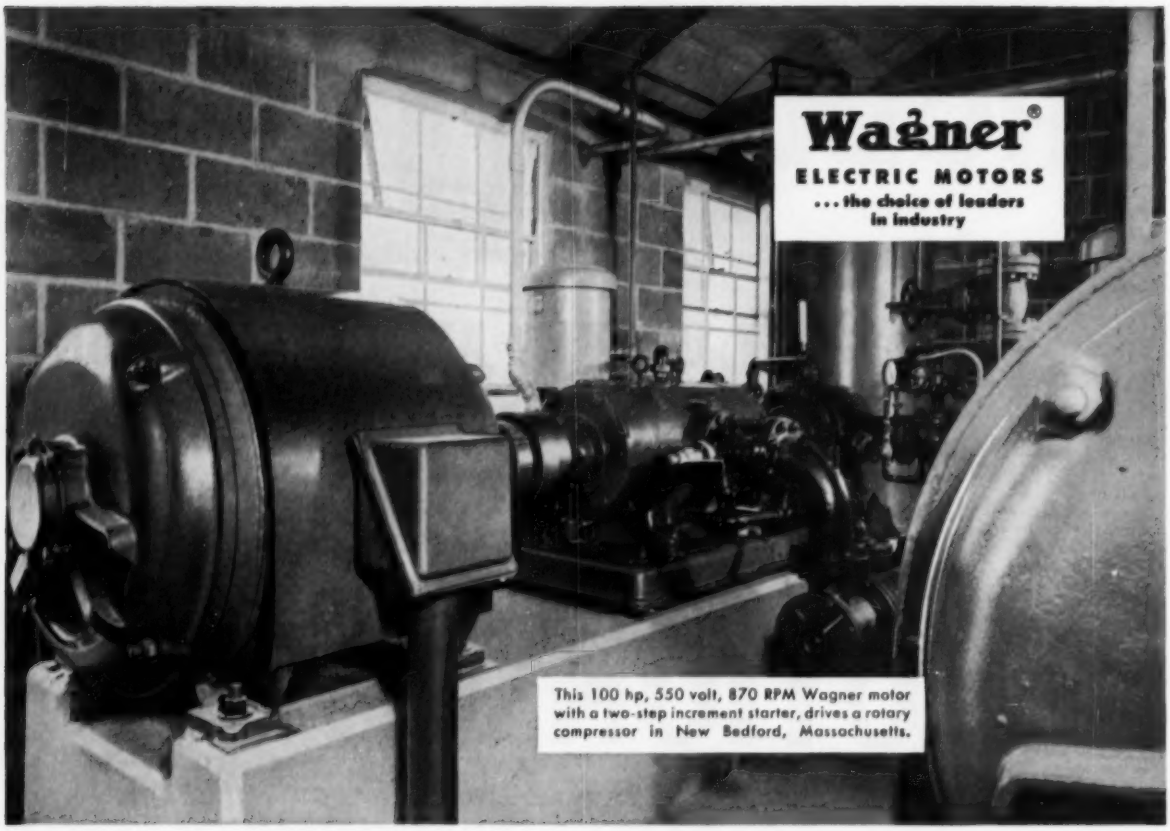

This 100 hp, 550 volt, 870 RPM Wagner motor with a two-step increment starter, drives a rotary compressor in New Bedford, Massachusetts.

Start large polyphase motors with minimum line voltage disturbance

USE THE Wagner INCREMENT MOTOR AND STARTER COMBINATION

Here's a modern, economical, highly efficient way to start large polyphase motors – the Wagner Increment Motor and Starter "Package."

By reducing current drawn from the line on each point of the starter, the combination limits the inrush of motor current to values that are acceptable for the distribution systems of most power companies.

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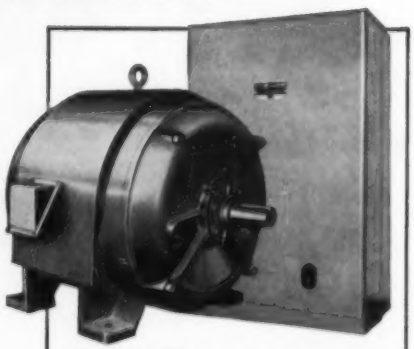
Your nearby Wagner engineer will help you select the increment motor and starter combination that meets *your* requirement. Call the nearest of our 32 branch offices, or write us.



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Glasfloss Air Filters help control atmosphere, lower air conditioning costs at world-famous research institute

More than 1900 Pittsburgh Glasfloss Air Filters are used every three months in the air conditioning system at this famous eastern research center to prevent dust build-up on electrostatic precipitators.

"Pittsburgh Glasfloss Filters help catch dust, prevent over-loading the electrostatic precipitators, lower maintenance costs through reduction of the number of times necessary for cleaning or flushing, and lessen the power load," reports the institute's director of engineering.

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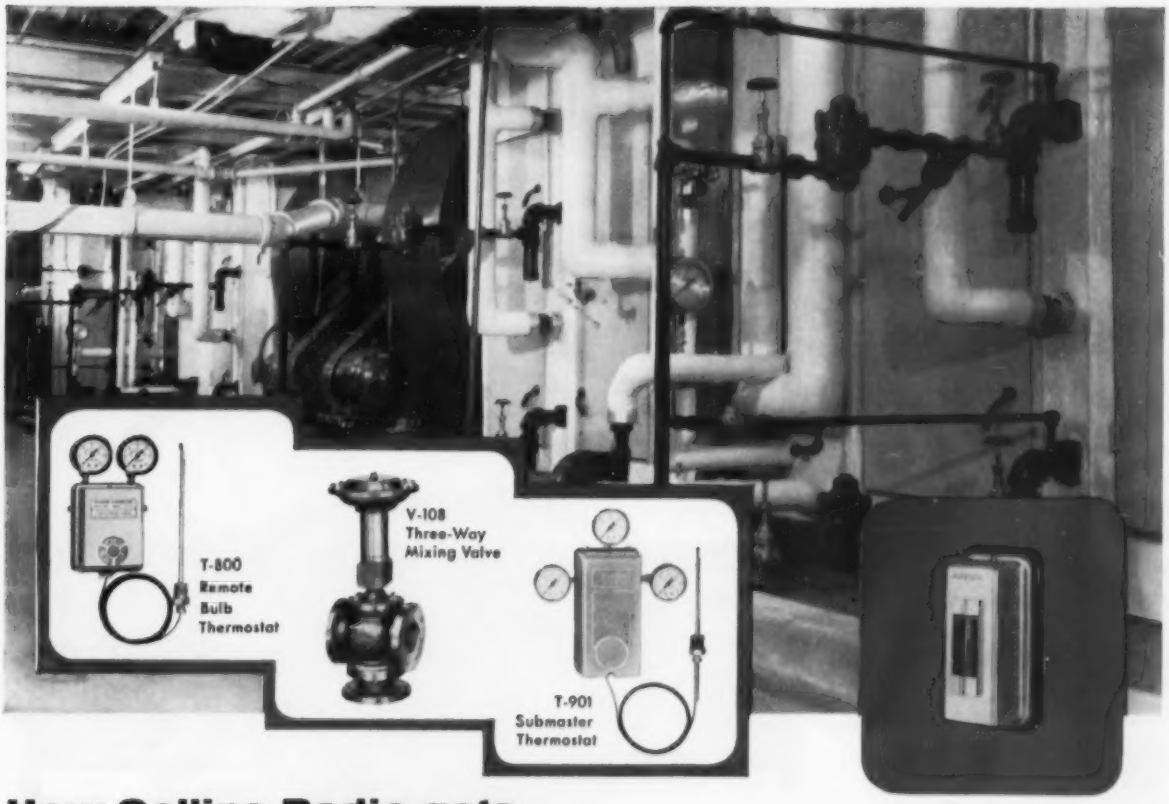

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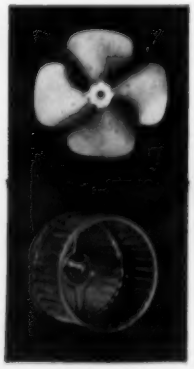

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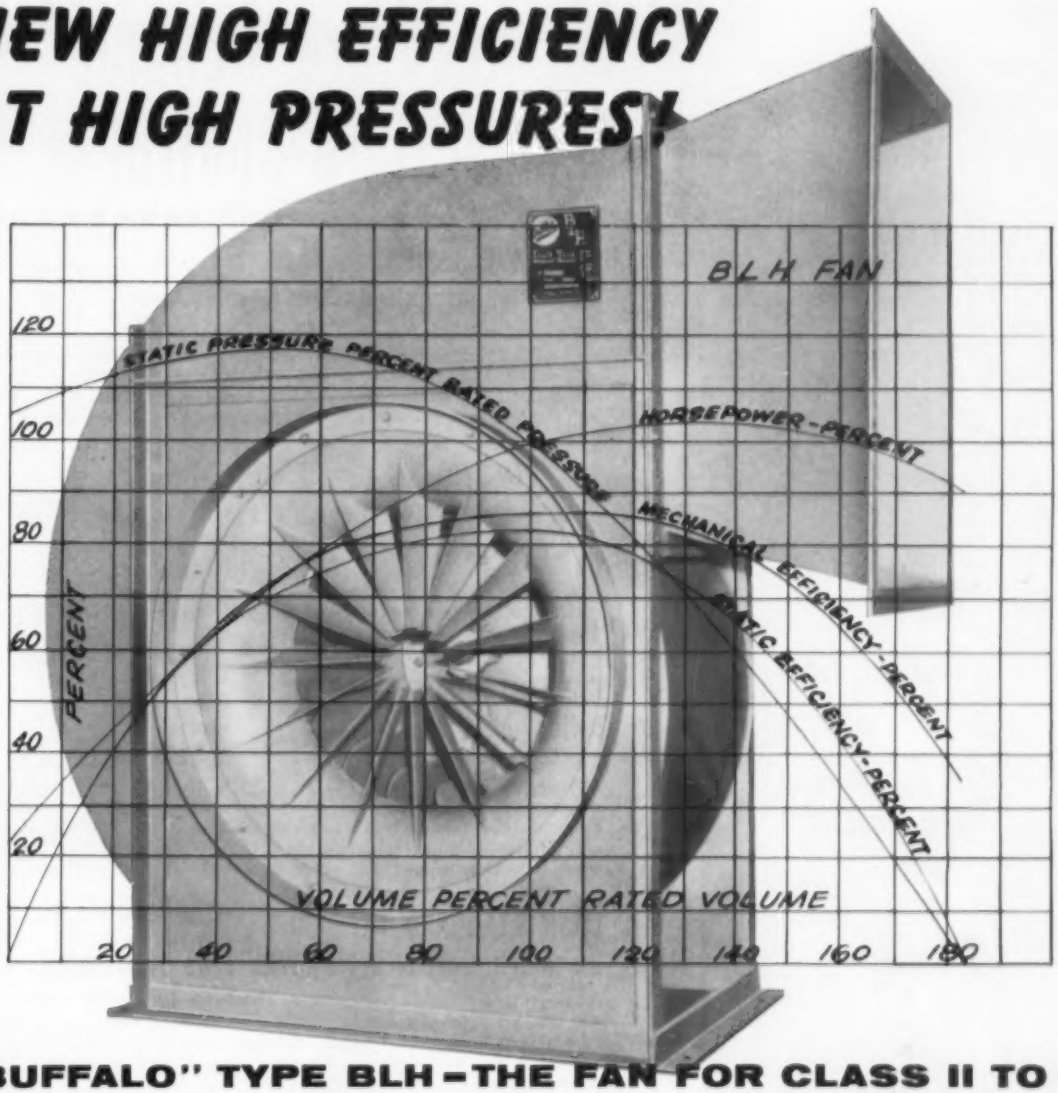

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WHEEL. The wheel has the highly efficient "Buffalo" non-overloading backward curved blades and a deep-drawn inlet flange which mates with the inlet bell to form the ideal true half-circle entry into the wheel.

OUTLET. The new divergent outlet reduces turbulence from fan cutoff into duct while making a *gradual* (instead of sudden) change from velocity to static pressure. Gives air the smoothest ride in history, for maximum efficiency.

"Q" FACTOR* CONSTRUCTION of the "Buffalo" Type BLH provides a new standard of performance impossible without this *complete* fan streamlining of inlet, wheel *and* outlet. Here, literally, is the "best of our 79 years" — the BLH — available to you in wheel diameters from 18¼" to 80¾".

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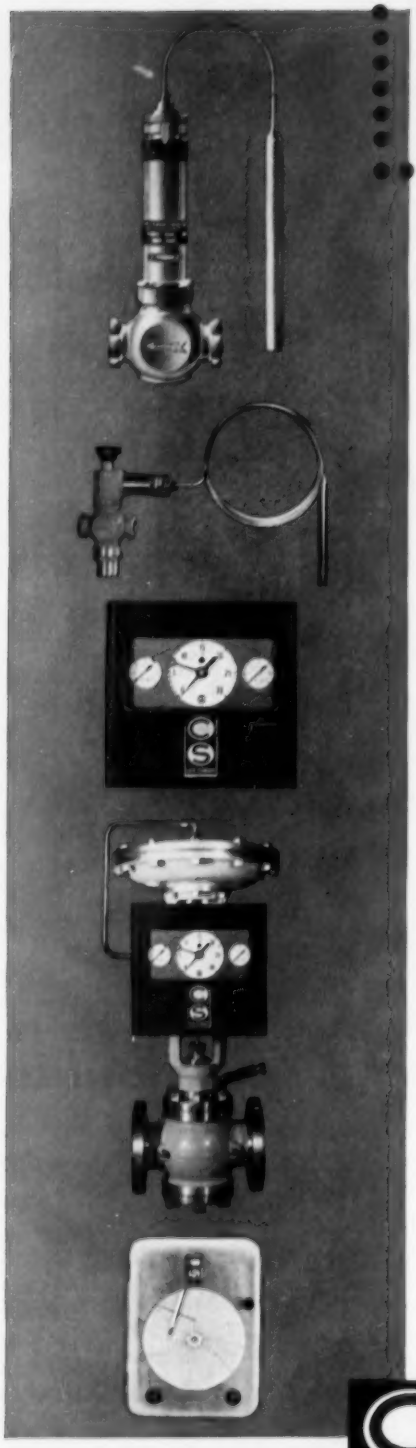

For Accurate, Reliable Temperature Control

STACON V SERIES
Self Operating Temperature Regulators—

Feature a liquid filled thermal system for high operating power and uniform throttling action and has built-in over-load protection. Available in 50°F. and 100°F. ranges from 25° to 325°F. Direct and reverse acting units ¼" to 1½" with screwed ends, and 2" to 4" with flanged ends. Bulletin No. 500. (Cash Standard Stacon Corp.)

STACON TYPE VS
Temperature Safety Regulators—

Used in the supply steam or gas line and will protect a process by snapping shut when the process temperature goes above a desired temperature level. Easily adjustable and remains closed until manually reset. Available in sizes from ½" to 1½" with screwed ends. (Cash Standard Stacon Corp.)

CASH STANDARD TYPE 51
Indicating Controllers—

An air operated, mercury actuated proportional temperature controller. Temperature ranges from —40°F. to 1000°F. Calibrated set point adjustment, unit construction, air relay with sapphire orifice and push button cleaner, feedback type proportional control with 1-100% band and differential gap. Also available with 1-150% proportional band combined with automatic reset action. Bulletin No. 978. (A. W. Cash Co.)

CASH STANDARD TYPE 30
Diaphragm Control Valve (With Type 51 Mounted)

A rugged, dependable control valve—available in sizes ½" to 12" with various styles of inner valves—reverse or direct acting. Accurate control is assured when the Type 30 is used with 51 or 57 controllers, valve mounted as illustrated, or where the controller is installed remotely. Bulletin No. 980. (A. W. Cash Co.)

CASH STANDARD TYPE 57
Recording Controllers—

An air operated temperature controller with mercury, vapor, gas or organic liquid actuation. Temperature ranges from —350°F. to 1200°F. Available in 9" and 12" case size, spring or electric driven chart drive, on-off control or 1-100% proportional control.

All units have push button nozzle cleaner; proportional controllers also have sapphire jewelled relay orifice with push button cleaner. Bulletin No. 979. (A. W. Cash Co.)

WHAT'S *YOUR* TEMPERATURE CONTROL PROBLEM?

Cash Standard and Stacon have the answer or will find one.

Contact the Cash Standard temperature and pressure control specialist in your area, or write Dept. B.

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A. W. Cash Co. and Its Subsidiary, Cash Standard Stacon Corp.
P. O. Box 551, Decatur, Ill.

PRESSURE, HYDRAULIC, TEMPERATURE, PROCESS AND COMBUSTION CONTROLS

INCREASE YOUR PRODUCT *Quality* with

COPPER HUSSEY BRASS

You can build extra quality into your products by using the special characteristics of Hussey Copper or brass. Take advantage of lifetime durability . . . corrosion-resistance . . . high efficiency heat transfer and electrical conductivity . . . and fine appearance. Profit, too, from the easy workability of Hussey Copper and brass that lends itself to basic production economies.

Order Hussey Copper and brass direct from the mill or from the closest of seven convenient warehouses.

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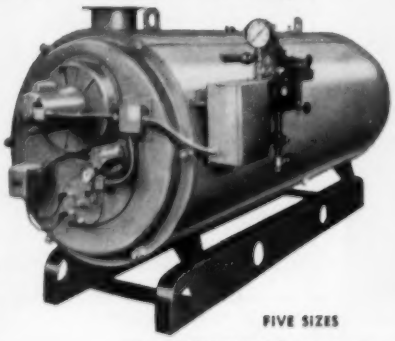
NEW *Progress* package eliminates "scatter buying" and installation delays of built-up jobs

• Contractors profit with Progress packaged boilers because they simplify boiler planning, purchase, and installation in four important ways: (1) *Save time* — you place *one* order . . . at *one* source . . . get *one* delivery . . . make *one* installation. (2) *Avoid confusion* — you end "parts" buying and tedious on-job assembly. (3) *Eliminate call-backs* — you install a fully fire-tested, smooth running boiler at the outset! (4) A *Finished Package* — you know it's built and backed by a single responsible manufacturer.

Get the complete facts — find out for yourself how to make more money with the new Progress "package."



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Up to 1,340,000 BTU Output. Steam or Hot Water. Gas or Oil Fired. Sold through Wholesalers Only.

Shipped direct to the job — ready for immediate installation. Base frame sets solidly on any floor. Completely wired — just make service connections. Cleaver-Brooks starting service representative places boiler into operation and trains attendant.

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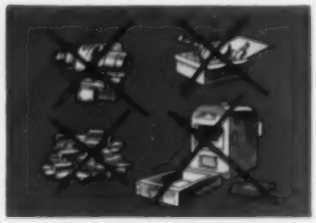
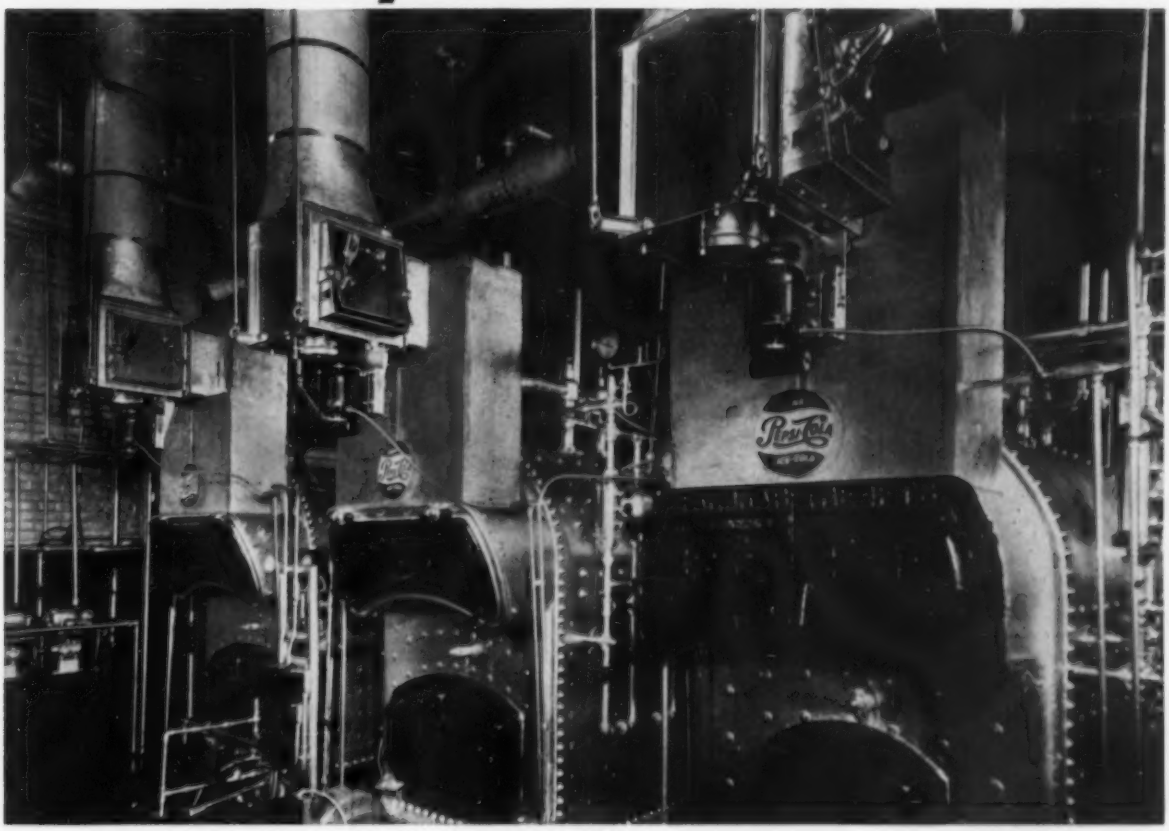


The "scatter-buying" way—multiple components. Wastes time and causes on-job confusion. With built-up boilers you have no single centralized responsibility — consequently call-backs are more frequent.

The Progress way to more heating profits. A completely integrated package — boiler, burner, controls and insulation — ready to install. Complete unit approval — bears the Underwriters Laboratories label.

Free starting service. After installation — final check and adjustment of boiler are made by authorized service representative. Attendant is also trained in operation and maintenance — at no extra cost.

Get "Million Dollar" Performance from Every Burner Installation



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3. Correct flame shape by eliminating draft variations.
4. Capital savings thru reduction of stack height.
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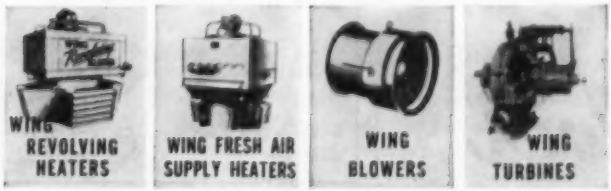

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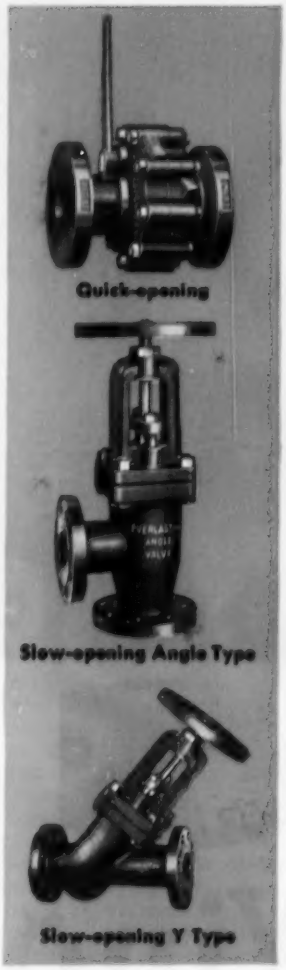
any way you choose for your boiler blow-off



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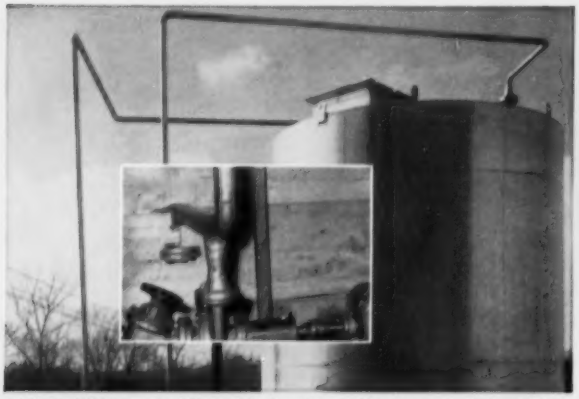
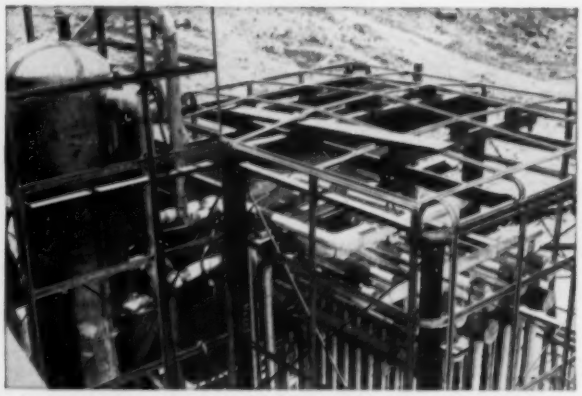
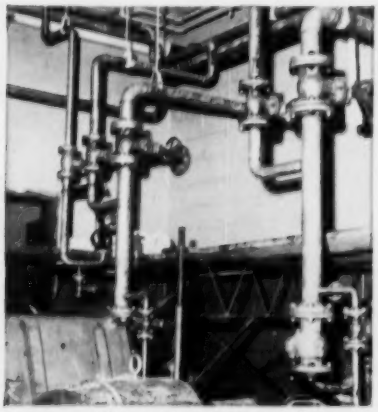


Oleic Acid Storage: Here, 2" aluminum lines carry oleic acid in this installation for a rubber company. TUBE-TURN Aluminum Welding Fittings are used for directional changes. Insert shows a compact combination of these fittings at a pump . . . an elbow, tee, reducer and flange.

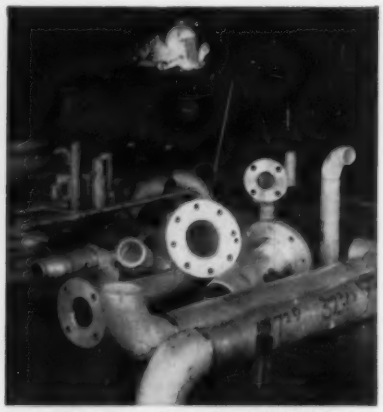


Oxygen Plant: TUBE-TURN Welding Fittings were used throughout this 25 tons-per-day oxygen plant for ore recovery. Here, operating temperatures range from 100°F to –320°F. Picture above shows reversing heat exchangers and fractionating tower prior to being enclosed in insulating shell.

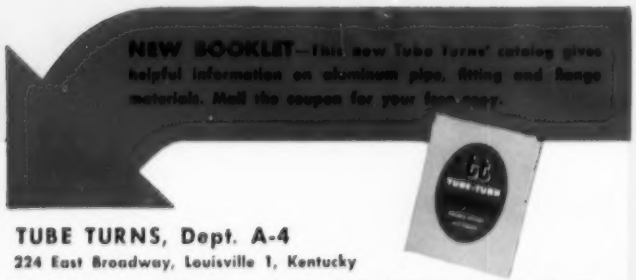


Catalyst Piping: Aluminum piping and fittings were specified for certain services in this new TCR bead catalyst plant to prevent contamination of the catalyst. TUBE-TURN Welding Fittings and Flanges were employed in all aluminum lines from 1" to 10". Result: Lines are permanently leak-proof – maintenance is minimized.

Refinery Wax Coils: Originally, retubing of seven wax sweaters in a large refinery called for coils of another metal. Switch to aluminum piping and TUBE-TURN Welding Fittings saved $50,000 in material costs! Each unit required 900 TUBE-TURN 180° Welding Returns of 1" OD.



Fast Fabrication: TUBE-TURN Welding Fittings and Flanges are dimensionally accurate. Rigid inspection by Tube Turns assures true circularity and uniform wall thickness. Result: Alignment is perfect; fabrication is faster; installation simplified.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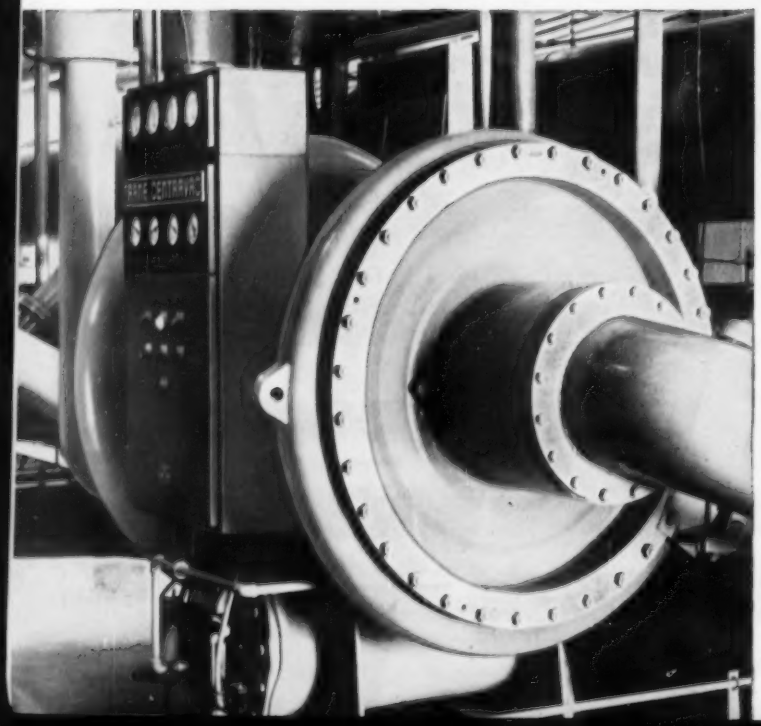
This ultra-modern, almost windowless, single-story W-K-M plant occupies 12 acres in a 75-acre site at Missouri City, Texas —20 miles from downtown Houston. The 2,250-ton TRANE air conditioning system uses chilled water in summer, hot water in winter—circulated through the same piping system—to provide ideal working conditions the year around. System was designed and engineered by the Dell Corporation of Morton Grove, Ill., using TRANE equipment throughout. Installation was made by Charles G. Heyne & Company of Houston, Texas. J. Emil Anderson & Son, Inc. of Houston and Chicago, were the designers, engineers and builders of the plant.

New 500,000 square *comfort* air



Three Trane CenTraVacs like this provide the chilled water for W-K-M's factory air conditioning system. These hermetically sealed compressors have a combined cooling capacity of 2,250 tons . . . chill 324,000 gallons of water per day. TRANE CenTraVacs were chosen for this important cooling job because of their ability to meet the wide variations in cooling demand. One, two or three units may be operated as the load fluctuates. Regulated entirely by automatic controls, they require no attendant.

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For any air condition, turn to

TRANE

MANUFACTURING ENGINEERS

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Year-around peak efficiency conditions for 1,100 employees in W-K-M's ultra-modern Houston plant!*

Perfect working conditions the year around are assured for the 1,100 workers in W-K-M's new plant near Houston, Texas. The 500,000 square foot factory building is completely air conditioned by TRANE equipment that cools in summer, heats in winter . . . provides built-in "ideal weather" all year long!

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Three TRANE CenTraVacs—hermetically sealed centrifugal compressors—supply chilled water for the factory system. A fourth CenTraVac handles the requirements of the administrative offices. Engineering offices are cooled by a #50 CT TRANE Condensing unit, with a TRANE Multi-Zone Climate Changer. Roof-mounted, the equipment transmits no noise into the building to disturb occupants.

Each year, more and more manufacturing plants are turning to TRANE for year around air conditioning because they have found that—in their plants or industries—modern air conditioning could more than pay its way by increasing production, boosting efficiency and reducing wasteful employee turnover.

For information on comfort or process air conditioning—for a new or existing plant—just call your nearby TRANE Sales Office. Or write TRANE, La Crosse, Wis.

**W-K-M Manufacturing Company, Inc. is a subsidiary of ACF Industries, Inc., specializing in the manufacture of valves and fittings for use in petroleum, gas, chemical and other process plants.*

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100 H.P. Century Performance-Rated type SCH Motor drives 4-stage compressor in air conditioning installation at large hotel.

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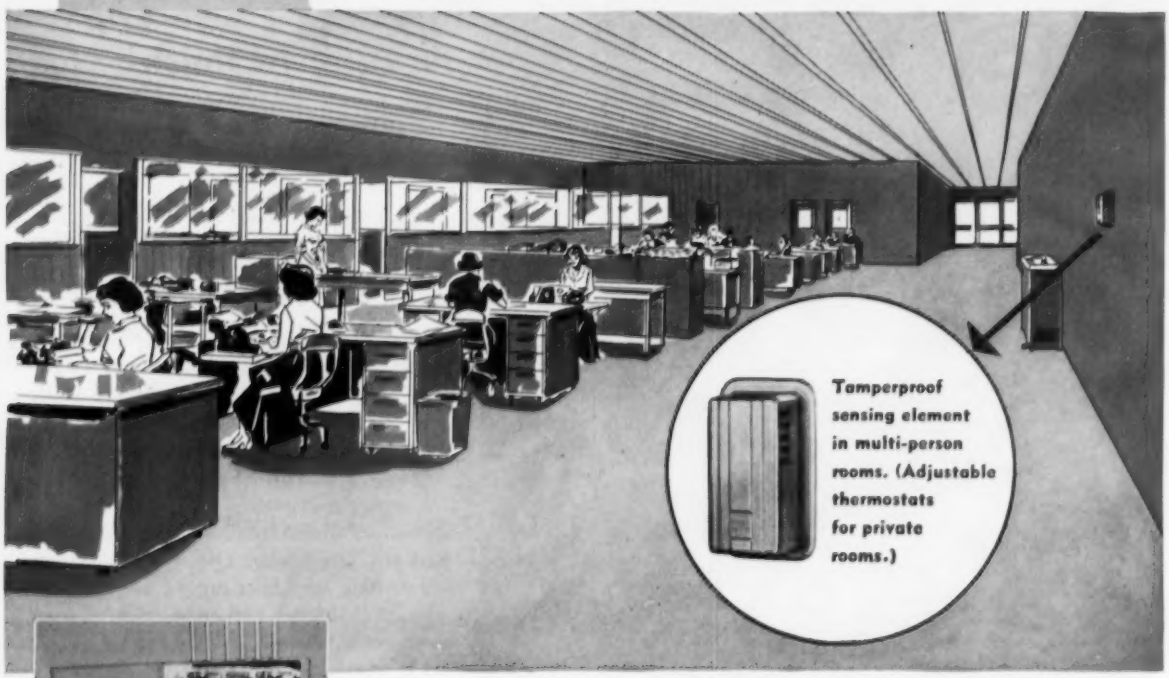

Remote temperature adjustment at "Control Center"

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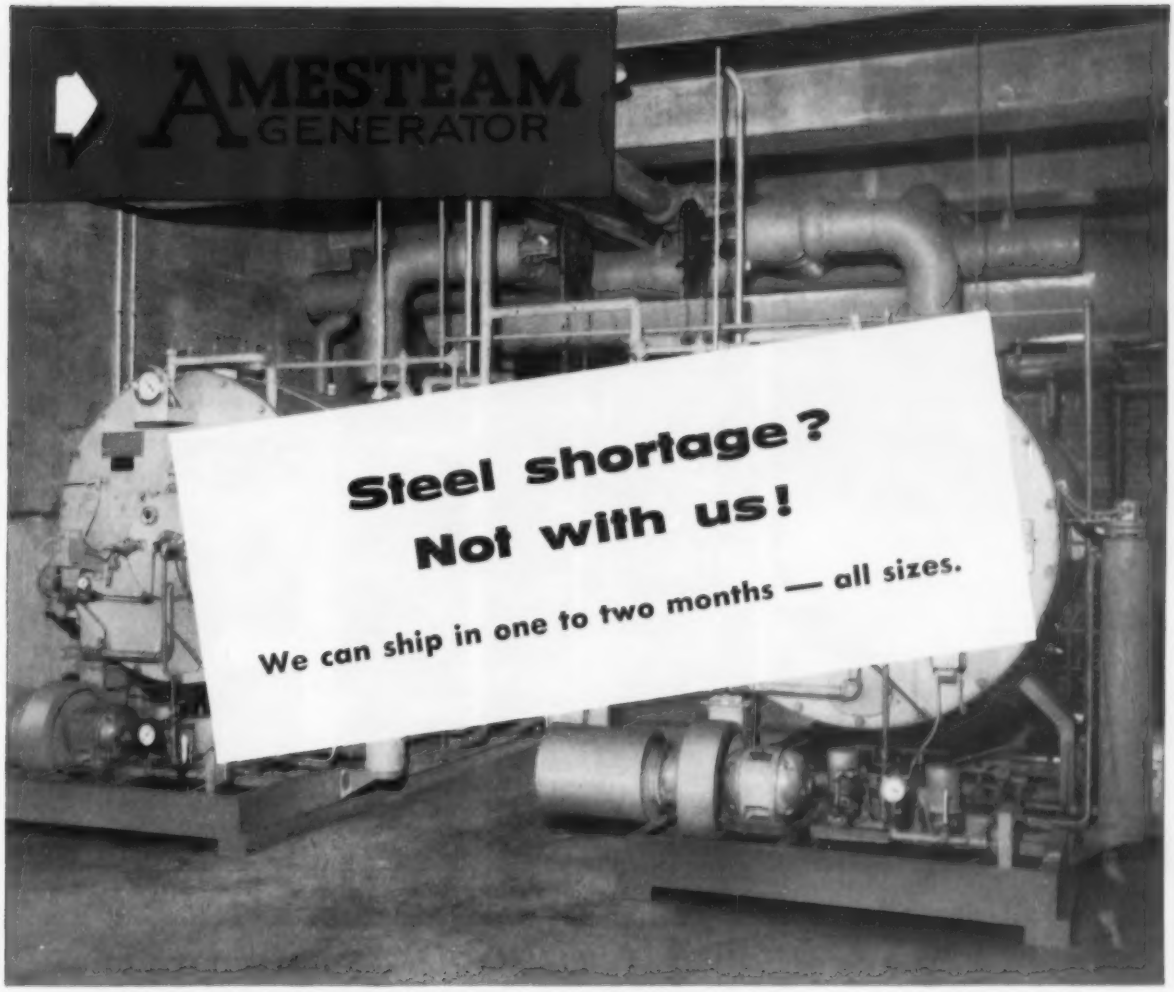

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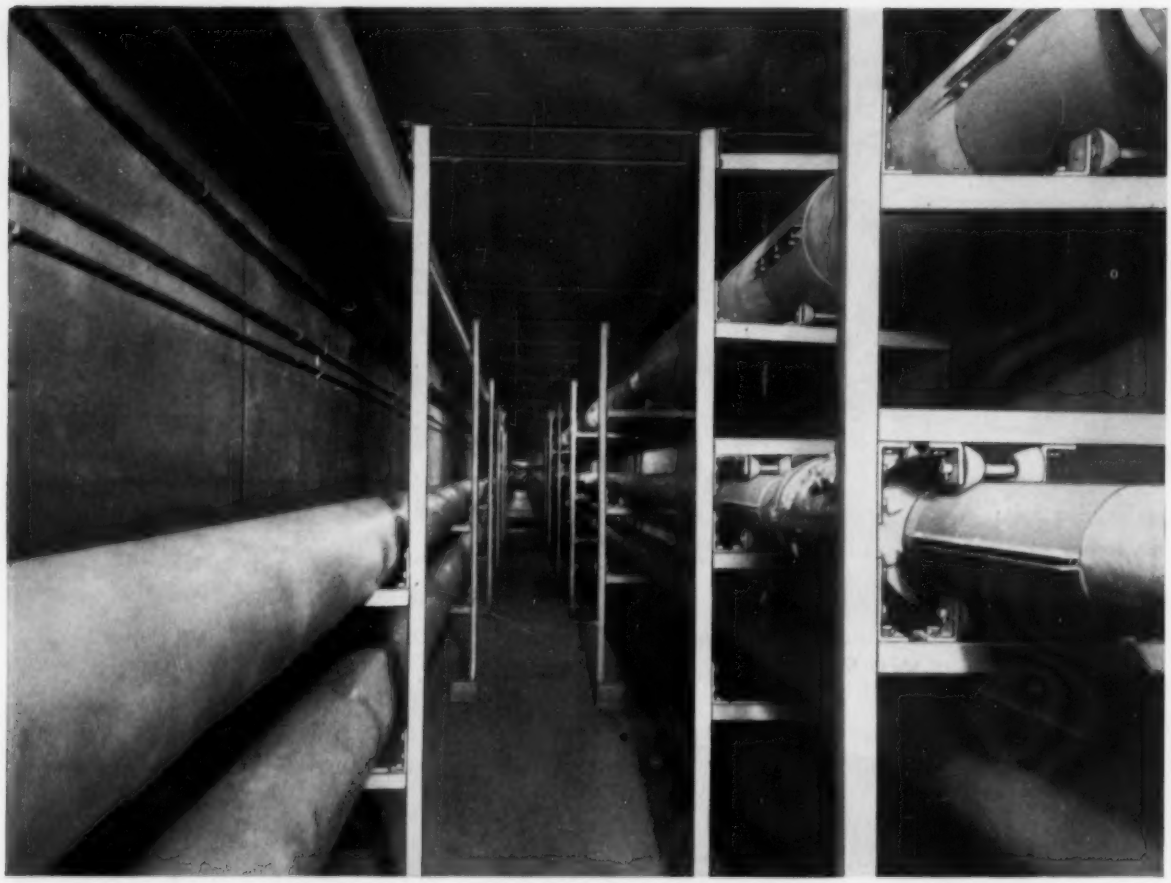

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(1) Cut UNISTRUT channel to length;
(2) slide in the UNISTRUT nut;
(3) tighten with a wrench. That's all!

Better still, you get everything you need in the complete UNISTRUT line—channel, clamps, hangers, concrete inserts, rollers, or any other accessories your installations require.

Think how this advanced method can cut your costs! No drilling, welding or riveting. No fussing to get exact slope or pitch—UNISTRUT framing is completely adjustable. And it's easy to alter or add to the installation any time—the UNISTRUT system is extremely flexible.

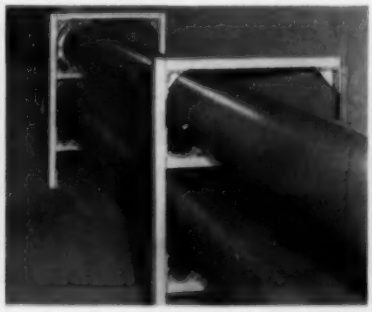
Here is the foolproof, economical method for superior support of steam, gas, heavy water, light conduit or air-conditioning lines. Find out about UNISTRUT framing now!

Write Dept. H-8 for 78-page Catalog No. 700, giving complete information.

UNISTRUT PRODUCTS COMPANY
933 W. Washington Blvd., Chicago 7, Illinois

UNISTRUT framing supporting unit heater—a tricky job made easy through horizontal and vertical adjustability of UNISTRUT.

UNISTRUT framing—with UNISTRUT concrete inserts—supporting heavy water and sludge lines.



U. S. Patent Numbers 2327587 2329815 2380379 2363382 2345650 2541908 2405631 2696135 Other Patents Pending

Rugged insulation finish for indoor and outdoor lines, tanks, and vessels

Reduce insulation costs by providing both finish and color identification at the same time with a protective coating of Armstrong Insulcolor. Insulcolor comes in seven colors, plus a clean white. It is applied by brush or spray to all types of insulated lines, tanks, and vessels, indoors or outdoors. There are no solvents in Insulcolor that create a hazard during application. Dried film is fire-resistant, and lasts for years under severe weather conditions. Maintenance is easy, as dirt washes readily from Insulcolor's smooth surface.

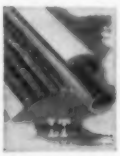
Insulcolor is one of the quality products in the complete line of Armstrong Industrial Insulations. Armstrong also offers you a complete contracting service, geared to install these products economically and efficiently.

For full details on Insulcolor or any other Armstrong materials that may help solve your insulation problems, send for free booklets. Check the ones you want on the coupon below.

Armstrong

INDUSTRIAL INSULATIONS

☐ Armstrong Insulcolor®, Weatherproof Coating in Seven Colors



☐ Armstrong LT Cork Covering, a New Type Cold Line Insulation

☐ Armstrong Armaglas Insulations for Pipes, Tanks, and Vessels

☐ Armstrong Armaflex*, a New Flexible Insulation for Piping

*TRADE-MARK

Armstrong Cork Company
2508 Sherman St.
Lancaster, Pa.

Please send me the free booklets checked. ☐

Please have an Armstrong representative call. ☐

Name .....

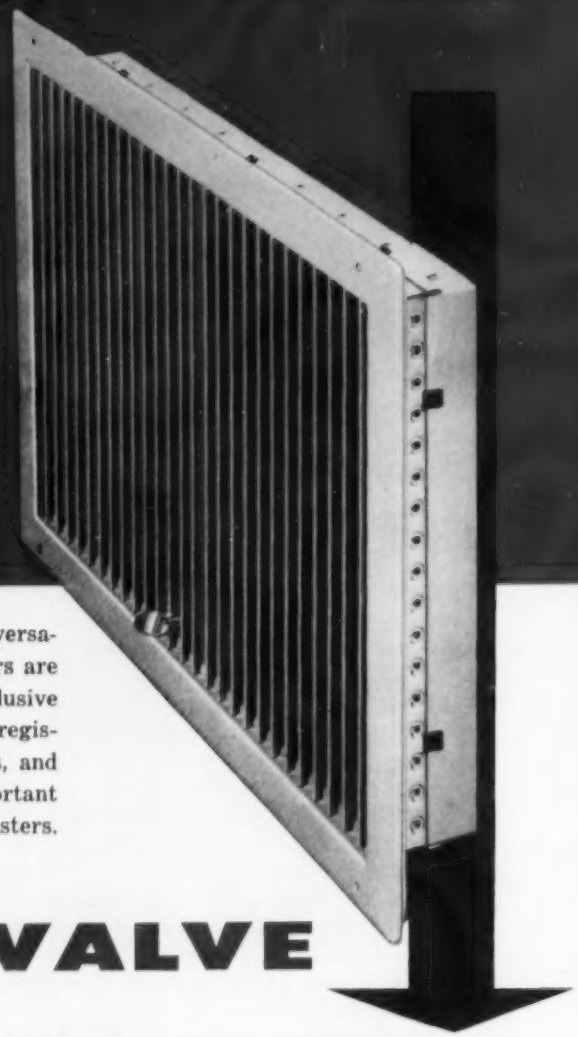
Position .....

Company .....

Address .....

City ..... Zone .... State .....

MULTI-TROL
COMMERCIAL REGISTERS
by Air Control
GIVE YOU THIS BIG DIFFERENCE*

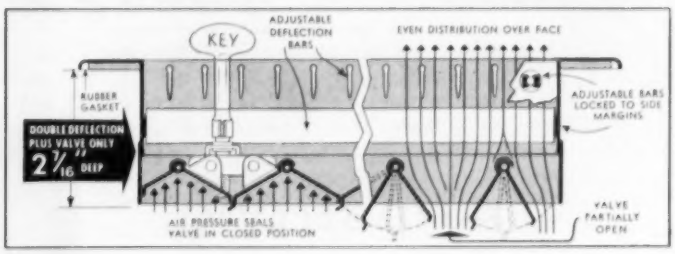


With Multi-Trol commercial registers you get performance and versatility no others can equal. Where ordinary commercial registers are too deep to be used with standard ducts, Air Control's exclusive Shallo-Valve solves the problem. Multi-Trol 4-way deflectional registers with Shallo-Valve can be installed in standard 3¼" ducts, and still leave ample space for adequate air flow. That's the important difference between Multi-Trol and any other commercial registers.

New* SHALLO-VALVE

EXCLUSIVE WITH MULTI-TROL COMMERCIAL REGISTERS

Multi-Trol Shallo-Valve louvers are the opposed-action type, designed to deliver air evenly over the face of the register at any velocity. When closed, air pressure seals the valve tightly, preventing annoying whistles. Adjustable bars and opposed-action valves provide positive 4-way control of the air stream. The Shallo-Valve of Multi-Trol registers, only 2½" deep, requires no special duct work in commercial or residential heating-cooling installations.


KEY
ADJUSTABLE DEFLECTION BARS
EVEN DISTRIBUTION OVER FACE
RUBBER GASKET
DOUBLE DEFLECTION PLUS VALVE ONLY 2 1/16" DEEP
ADJUSTABLE BARS LOCKED TO SIDE MARGINS
AIR PRESSURE SEALS VALVE IN CLOSED POSITION
VALVE PARTIALLY OPEN

Only Multi-Trol commercial registers by Air Control offer you all these advantages:

Key-operated Shallo-Valve — Minimum Air Resistance — Air Foil Contour Face Bars — Modern Styling with smooth, rounded corners — Handsome beige finish. Pivots of adjustable face bars are locked into margin, can't pull out.

Multi-Trol registers and grilles come in a wide range of sizes and styles for every need. See your favorite jobber.

WRITE FOR CATALOG 56-AC SHOWING THE COMPLETE MULTI-TROL* LINE

*Patent Pending

AIR CONTROL PRODUCTS, INC., Pace St., Coopersville, Mich.

NEW NEW NEW

72-PAGE EXPANSION JOINT MANUAL

More than just another catalog. It is actually a complete and authoritative text that covers every phase of expansion joint design, construction, selection and installation.

Separate sections deal with the various types of Zallea Expansion Joints for absorbing axial, lateral and rotational movements.

New Zallea HyPTor Expansion Joints for high pressure applications are introduced.

Over 40 pages of tables and engineering data simplify expansion joint selection.

This manual is a must for any engineer having problems that involve the movement of piping due to temperature changes.

Write today, on your company letterhead, for your copy of Catalog 56.

Zallea *expansion joints*

ZALLEA BROTHERS, 816 LOCUST STREET, WILMINGTON 99, DELAWARE

World's Largest Manufacturers of Expansion Joints

Announcing—

the New Morrison Unit Drive Blower

DESIGNED
to use any make
"OFF THE COUNTER"
Standard NEMA frame motor

Permanent split capacitor, split phase or shaded pole motor

Check . . . these features

Simplifies Service
Unified inventory — one motor can be used on a whole range of blower sizes.

Quiet Operation
Time tested and approved resilient mounting. Equipped with Fafnir Super-Quiet Ball Bearings.

Minimum Service
No belt replacement • No belt tension problem • No belt noise • No alignment problem • No loose collars • No need for pulleys.

Maximum Air Delivery
Unrestricted inlets allow maximum air delivery.

Even Air Distribution
Motor Mount in center of wheel allows even distribution of air across blower outlet.

Performance Advantages
Belt drive blower blade sections used in the wheel, give close comparable performances to belt driven blowers and retain all the packaged unit advantages of a direct drive.

Sturdy Construction
Double end suspension assures maximum safety — maximum motor and bearing life.

The MORRISON Unit Drive Blower can be installed in any position. It is furnished in a complete range of sizes that are dimensionally interchangeable with standard belt drive blowers.

WRITE FOR CATALOG **TODAY** . . .

MORRISON PRODUCTS INC.

16816 WATERLOO RD.
CLEVELAND 10, OHIO

At the magnificent
FONTAINEBLEAU
Miami Beach, Florida

Morris Lapidus, Architect, New York and Miami Beach; Sawnett & Bennett, Consulting Engineers, Miami.

. . . the most elaborate provision for human comfort ever devised depends on PETRO oil firing for heat

Each guest in the luxurious new Hotel Fontainebleau can select the temperature for his own suite—whether for heating or cooling.

Down to the smallest detail, this $15,000,000 building represents a thorough search for the best that America can provide in equipment, furniture and fittings. The particular quality that won a place for Petro oil firing equipment in this select company was its proved DEPENDABILITY in precision firing of a difficult fuel—low cost heavy oil.

A whole firing system in one package

The Petro units shown here go far beyond the usual oil burner—they are complete combustion systems with matched Kewanee boilers engineered for this particular use. The result is a fully integrated boiler-burner unit with every component built in—control panel with instruments factory mounted, wired and tested, forced draft air supply, fuel system—all under one contract and one responsibility.

For gas, oil or combination gas-oil firing

Standby oil equipment is required in many areas where gas is the principal fuel. But the ability to switch fuels quickly is a great advantage whether required or not. It protects against fuel emergencies and cuts fuel costs. Petro models are available for single or dual fuel firing in a wide range of sizes.

For further information mail the coupon, or look in the yellow pages of your telephone directory for the nearest Petro dealer.

Three Petro forced draft oil burners with matched Scotch type boilers in the Fontainebleau boiler room. This plant supplies domestic hot water in addition to steam for heating and laundry. Petro distributor: Florida Fuel Oil Co., Miami.

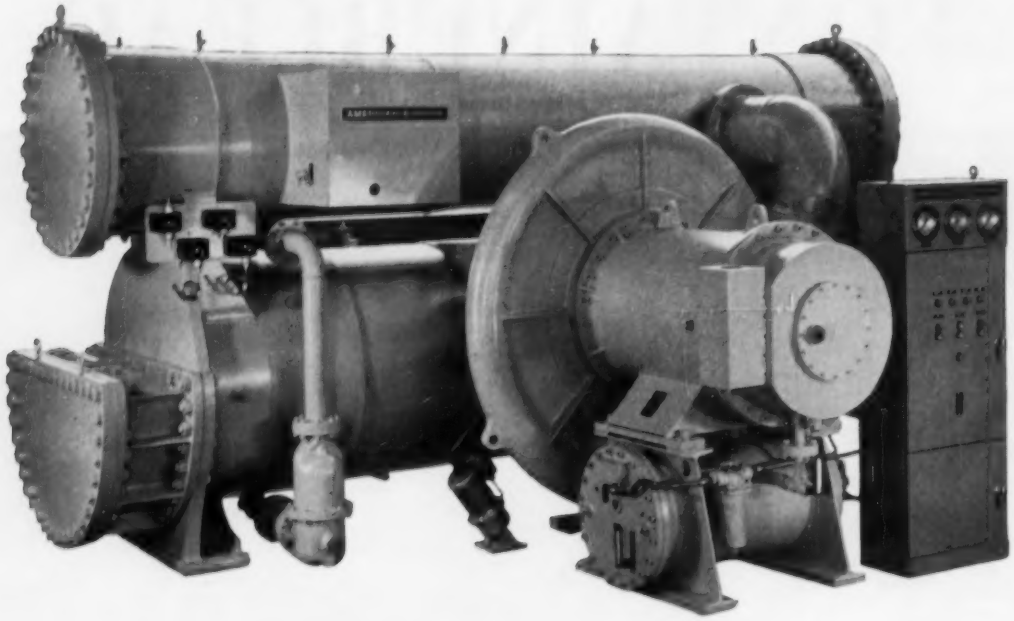
PETRO
T. M. REG. U. S. PAT. OFF.

Over 50 years of leadership in automatic heating and power equipment

PETRO
5229 West 106th Street, Cleveland 11, Ohio
In Canada: 2231 Bloor St., West, Toronto, Ontario
Please send the 20-page illustrated Petro catalog.

Name _____
Company _____
Address _____
City _____ State _____

AMERICAN BLOWER
AIR CONDITIONING



Tonrac* maintains chilled-water temperature–regardless of load!

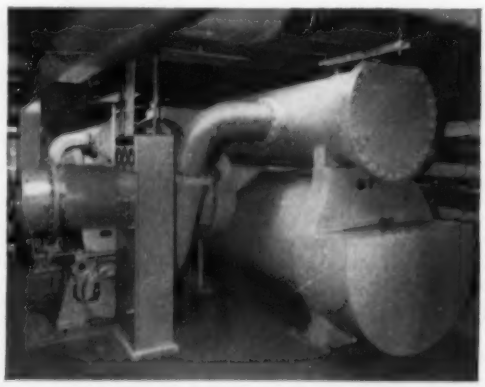
American Blower's single-stage hermetic centrifugal refrigerating machine – Tonrac – automatically adjusts refrigerating capacity to cooling needs. "Tracking the load," Tonrac operates efficiently from full load to no load.

Variable inlet guide vanes regulate the quantity, velocity and direction of the refrigerant gas flow to the compressor in direct response to the amount of cooling load.

Single-stage design eliminates two or more compression stages with their inherent cross-over losses. This, plus improved diffusion in the volute casing, insures optimum performance, quieter operation.

What's more, Tonrac's *single-level* construction requires no built-up bases. A compact, self-contained unit ready for installation, Tonrac may be located wherever the floor will support the charged weight of the system – even on the roof.

For further information on Tonrac, contact our nearest branch office, or write us direct. American Blower offers a complete product-line – from Packaged Air Conditioners, to Multi-Zone Units and Central Station Air Conditioners – to meet *all* your air conditioning requirements! American Blower Corporation, Detroit 32, Michigan. In Canada: Canadian Sirocco Company, Ltd., Windsor, Ontario.



Compactly designed, accessible – Tonrac operates on constant-speed 3600 rpm motor. Push-button control (left foreground) initiates quiet, efficient, automatic operation.

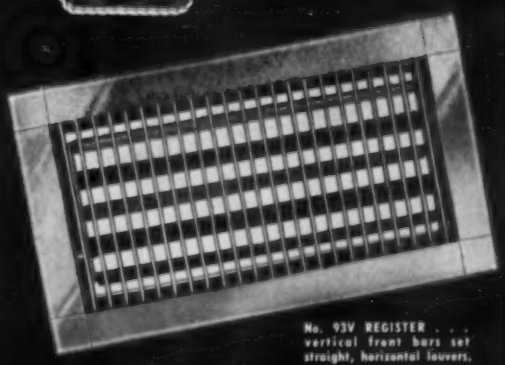
*TRADEMARK

AMERICAN BLOWER

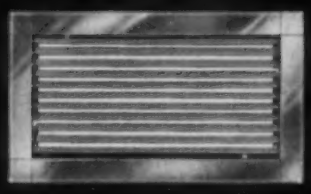
Division of American-Standard

Air conditioning equipment for every business

H&C FIXT-*AIRE* . . .



No. 93V REGISTER . . . vertical front bars set straight, horizontal louvers.



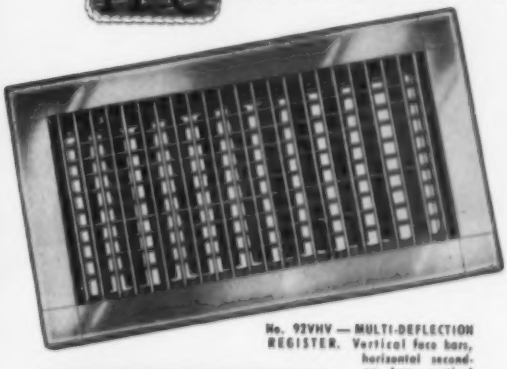
No. 94A GRILLE . . . horizontal face bars set at 22° angle for up or down deflection.

. . . return air registers and grilles designed to complement and harmonize with the TRIPL-AIRE line. Registers have a single bank of face bars in fixed vertical or horizontal position, and feature the same opposed louver construction for positive volume control found in TRIPL-AIRE units. Grilles are available with horizontal face bars set at 22° angle for up or down deflection where desired. One-piece sizes up to 36" x 30".

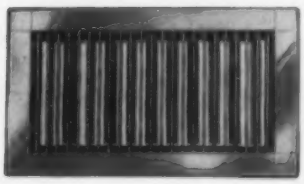
CONVENIENT CATALOG GIVES COMPLETE DETAILS AND ENGINEERING DATA . . .
Available from H&C Jobbers or write direct.

MEMO:
See The New H&C Line
That's Gaining Such
Unusual Acceptance For
Commercial Installations

H&C TRIPL-*AIRE* . . .



No. 92VHV — MULTI-DEFLECTION REGISTER. Vertical face bars, horizontal secondary bars, vertical louvers. Also available without valve No. 92VHO.



No. 92VOV — SINGLE DEFLECTION REGISTER with vertical face bars and louvers. Also available without valve, No. 92VOO.

. . . is gaining popularity, because wherever these units are installed they "do the job", and do it right. And that's because in this one basic line of 26 standard sizes there are 260 possible horizontal and vertical deflection combinations . . . designed to provide any air flow pattern required. No need to compromise when you use TRIPL-AIRE. The ten TRIPL-AIRE combinations are available in twenty-six standard sizes, up to 36" x 12", as well as in intermediate sizes, up to 36" x 36", to order. Front adjustments control face bars and louvers, and opposed louvers permit absolute volume control with equal air distribution over entire face. Top quality "Decorator Gray" enamel finish. H & C Jobbers have complete details.

& COOLEY MANUFACTURING CO.
DEPT. 2-AC, HOLLAND, MICHIGAN

ONE OF THE GARLOCK 2,000

"KING-SIZE" FOR KINGSTON

GARLOCK RUBBER EXPANSION JOINTS

At the TVA's Kingston Steam Plant (the world's largest) the total capacity is 1,600,000 Kilowatts, made up by four 150,000 KW steam turbogenerators and five 200,000 KW turbogenerators.

80,000 sq. foot condensers, drawing 65,000 gpm. of cooling water, are spring mounted on the exhausts of the 200,000 KW turbines. 60" dia.

Garlock Rubber Expansion Joints installed between condenser water inlet and concrete imbedded water piping, compensate for misalignment and provide for expansion and contraction.

These "King-Size" Rubber Expansion Joints are only part of "the famous Garlock 2,000" . . . two thousand different styles of gaskets, packings, and seals to meet *all* your needs . . . the *only* complete line available.

Call one of Garlock's 125 factory trained representatives for *unbiased* recommendations, or write for Expansion Joint Folder AD-137.

THE GARLOCK PACKING COMPANY, Palmyra, New York

For Prompt Service, contact one of our 30 sales offices and warehouses throughout the U.S. and Canada

GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Rubber Expansion Joints

NOW OFFER YOUR CLIENTS ...

Electronically Clean Air

ELECTRO-STAYNEW PRECIPITATORS

remove even microscopic airborne particles

FOR INDUSTRY

Electro-Staynew reduces absenteeism and sickness in plants. Removes over 90% of *all* airborne dirt, dust, smoke, soot, pollen, etc. Improves plant efficiency and quality control. Extremely low maintenance cost, economical operation.

FOR THE HOME

Persons allergic to airborne particles will welcome the electrostatic filtration of Electro-Staynew House Precipitators. Easily installed in any air circulating system, they remove particles as small as 1/200,000 of an inch . . . use less current than a 50 Watt light bulb.

AFI MEMBER

Write for more information on Electro-Staynew Industrial Precipitator (Bulletin 400); or write for Home Precipitator Bulletin 440. The Dollinger Corporation, 9 Centre Park, Rochester 3, N. Y.

DOLLINGER PRECIPITATOR ELECTRO-STAYNEW

DOLLINGER CORPORATION

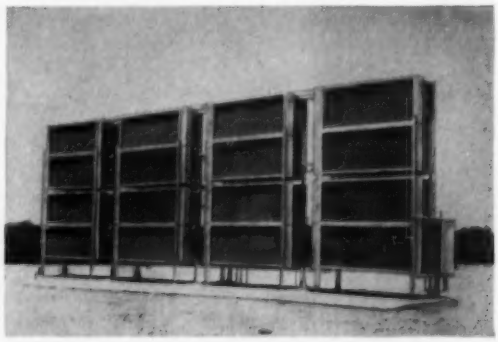
ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS
ELECTROSTATIC FILTERS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS
VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS
AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

Crashing the 100 ton barrier

with KRAMER UNICON

in semi-tropical climate



UNICON SUCCESSFULLY MET THE TEST THROUGH THE SEVERE SUMMER OF 1955

You, too, can crash the big tonnage barriers with UNICON, the industry's finest remote-type air-cooled condenser. Put Kramer's 18 years of "treasured know-how" in the proper use of air as a condenser coolant to work for you.

Photo of Kramer UNICONS mounted on roof of Handy-Andy Supermarket in San Antonio, Texas, used with 100 ton air conditioning system. Supplied through United Supply Co., of San Antonio and installed under the direction of Harold Vogt.

Write for Bulletin U-210-L

KRAMER

KRAMER TRENTON COMPANY
Trenton 5, New Jersey

Bayley

FAN-A-GRAFICS

For Equipment Engineers

"Do's and Don'ts"

OF FAN APPLICATION

DO familiarize yourself with NAFM standards and practices.

DON'T use outlet velocity alone to measure suitability of a given fan to given performance. The ratio of velocity pressure to total pressure is the proper determinant.

DO remember that for a fan of given type and proportions at constant volume and constant point of rating, the wheel diameter varies inversely as the 4th root of the static pressure.

DON'T use multi-blade or close-bladed fans for handling dusts, air-borne solid materials, or under severely corrosive-abrasive conditions unless special construction is provided to resist wear.

DO avoid extremely high wheel speeds in materials handling fans, particularly under corrosive or abrasive conditions. For high-velocity requirements design for injection or induction, so material does not pass through fan.

DON'T obstruct flow to inlet of fans in plenums. Keep inlet at least one wheel diameter from walls or other obstructions. This is particularly important for double-inlet fans.

DO avoid turbulence at fan inlets or outlets, as fan performance may otherwise be adversely affected.

DON'T use direct drive unless performance is accurately determinable, variable speed driver is to be used, or good system control is available.

DO evaluate motor or prime-mover limitations when considering Arrangement 4 fan applications. This arrangement is particularly undesirable for large-size or heavy-duty fans.

DON'T specify or use small-fan arrangements having bearing in inlet. The bearing is excessively obstructive. Such arrangements are not regularly available in small size single inlet fans.

DO use double-width fans where headroom is a paramount consideration, rather than unduly small single-width fans.

DON'T specify arrangements having bearing in inlet if corrosive, abrasive, or high-temperature materials pass through fan. If double inlet fan is necessary, use inlet boxes and outboard bearing pedestals.

But Above All--
DO Specify
And Use

Bayley **FANS**

Engineered
AIR HANDLING EQUIPMENT

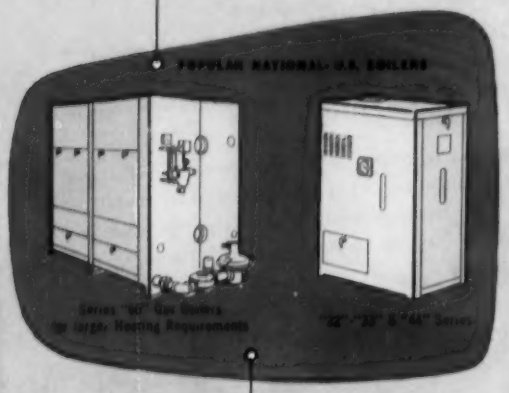
BAYLEY BLOWER COMPANY

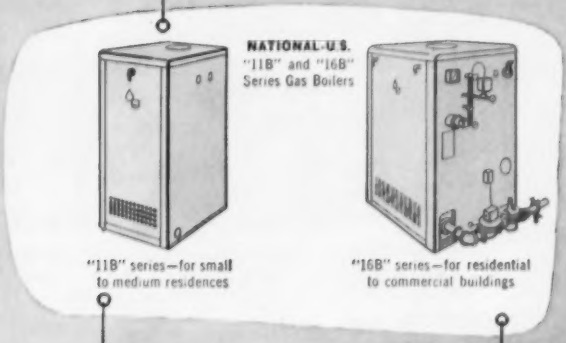
6600 W. BURNHAM
MILWAUKEE, WISCONSIN

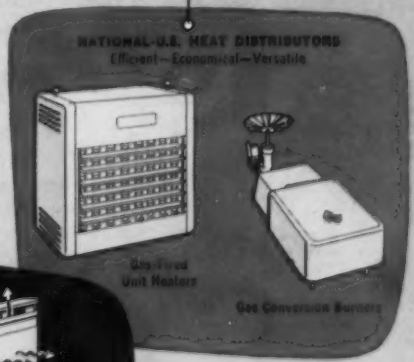
CATCH HOLD of this BALANCED LINE of Gas Fired Products for MORE PROFITABLE BUSINESS

Now available under one brand name is a fully integrated line of modern gas-fired boilers, unit heaters, conversion burners and heat distributors to meet all central heating system requirements of every size and type of home and building.

A quality line—recognized for high standards of quality and service—easy to sell—with good profit margin—easy to install—readily accepted—assuring long, dependable performance and satisfaction.







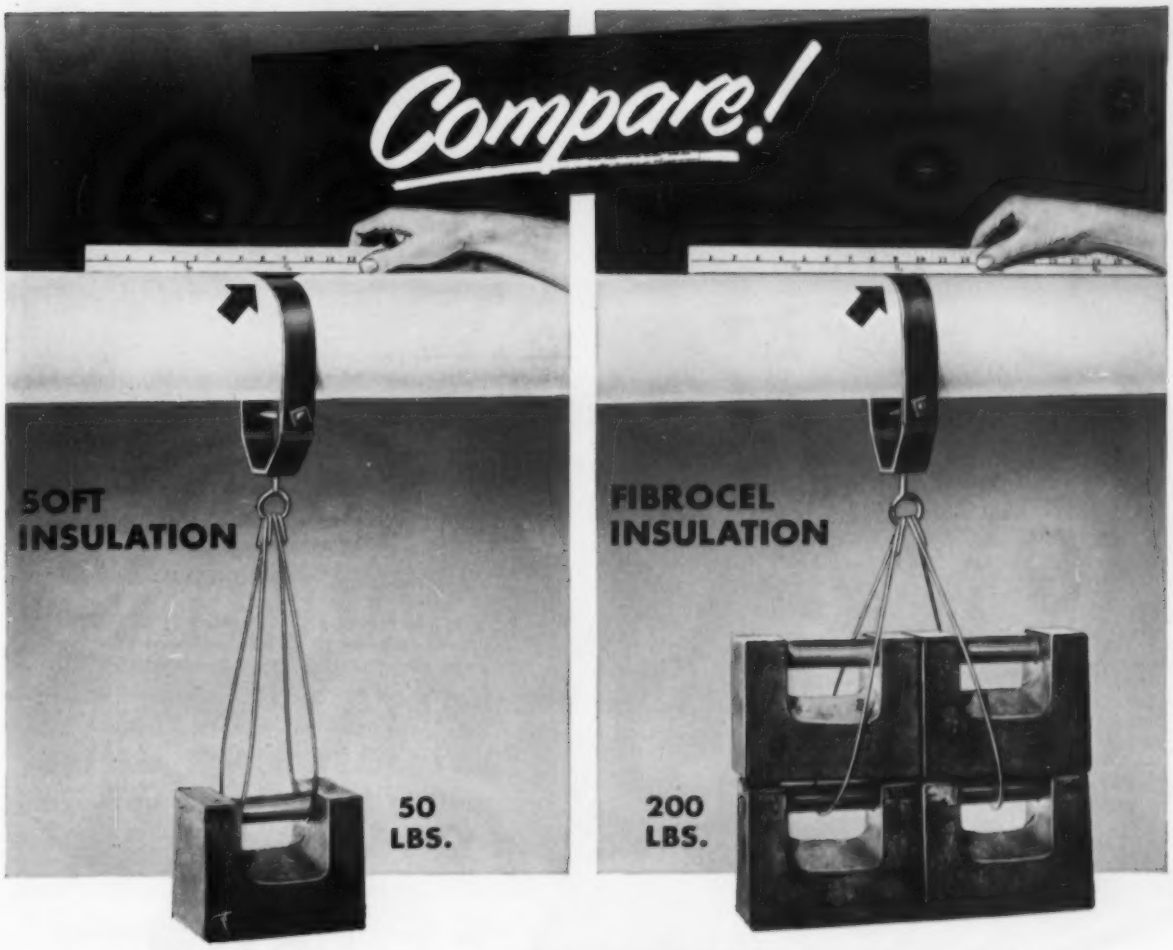
National-U.S. Radiator CORPORATION

HEATING AND AIR CONDITIONING DIVISION
Johnstown, Pennsylvania

Sales Offices and Representatives in principal cities

Write for Bulletins giving full information and engineering data with ratings on each individual series of National-U.S. Gas Boilers.

All National-U.S. Gas Heating Products bear the A.G.A. approval seal or are listed by the American Gas Association.



Compression test proves J-M Fibrocel® Insulation retains *FULL-WALL* thickness!

ONLY FIBROCEL OFFERS ALL THESE ADVANTAGES

No shrinkage—eliminates gaping joints. **Resists compression**—retains full-wall thickness. **Uniform dimensions**—precision formed for exact fit. **Economical application**—lightweight, easy to cut with a knife. **Thermally effective. Long lasting**—flame, rot, odor and vermin proof.

the new molded silica insulation developed for plumbing, heating, chilled water and dual service applications in the 35F to 300F temperature range

The illustrations tell you why Fibrocel maintains its insulating effectiveness . . . why it stands up under operating abuse which often impairs the performance of softer insulations.

At top left, a *single* 50-lb. weight noticeably crushes the soft ordinary insulation. But note that *four* of these same weights cause no deformation or compression in Fibrocel. *This means full insulating effectiveness!*

Fibrocel's added firmness and strength take on even more importance when a vapor seal jacket is involved. For Fibrocel offers substantially greater back-up protection against jacket punctures.

Fibrocel speeds installation, too! It is light in weight and a pleasure to apply. It cuts cleanly, easily with a knife. And its firmness and remarkable dimensional uniformity assure long-lasting, tight, smooth joints!

For further information on Fibrocel, write Johns-Manville, Box 60, New York 16, N. Y. (In Canada, Port Credit, Ontario.) Ask for brochure IN-155A.

JM PRODUCTS

Johns-Manville *first-in* INSULATION

MATERIALS · ENGINEERING · APPLICATION

The benefits of air conditioning should be FELT... not HEARD!

SEALMASTER'S

Rubber Mounted-Zone Hardened

BALL BEARING UNITS

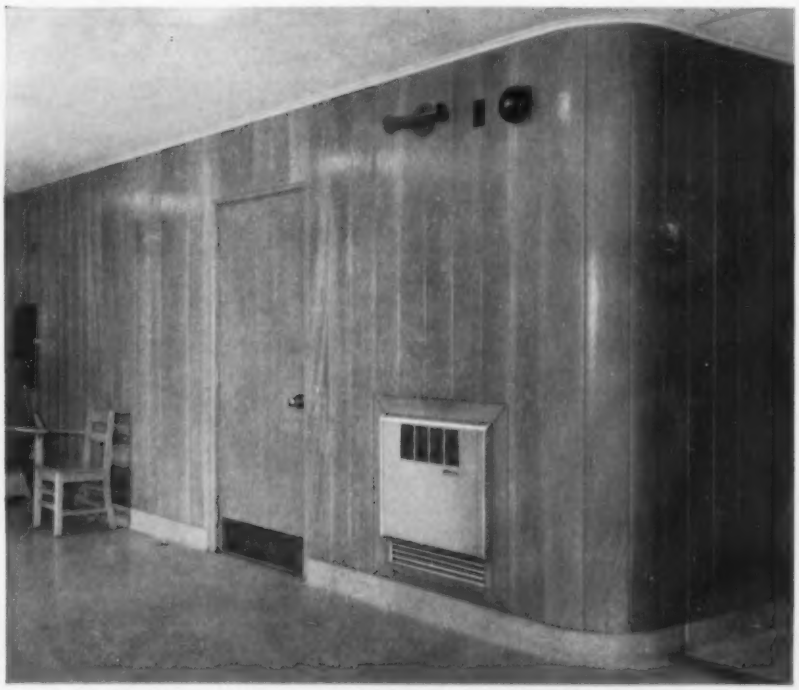
assure long, quiet service

Write for Bulletin 1253. It's a must for your files.

Silent operation and smooth, continuous performance is the desire of any air conditioning manufacturer in the products he designs and builds. SEALMASTER Zone-Hardened, Rubber Mounted Ball Bearing Units reduce noise, vibration and wear and assure continuous, quiet, trouble-free operation. A Zone Hardened SEALMASTER Ball Bearing Unit is mounted in a synthetic oil-resistant rubber ring which fits snugly into a pressed steel housing—pillow block or flange type. (Cartridge units available for insertion in special and built-in housings.) The result is a compact bearing unit which, when built into your product, affords you a quality feature your customers will appreciate. It will pay for itself in product performance and repeat sales.

SEALMASTER BEARINGS A DIVISION OF STEPHENS-ADAMSON MFG. CO. • 47 RIDGEWAY AVE., AURORA, ILLINOIS

It's easy to give large rooms and entryways that Warm welcome



Type BF cabinet units, equipped with plenum bases and partially recessed in wall, maintain comfort in the hallways of this large midwestern elementary school.

Recessed in the counter, a Type BF keeps out cold air when door opens.

Using ducts, cabinet units heat adjacent rooms as well as auditorium.

the answer . . . *Modine* Cabinet Units

For that lasting "warm-welcome" first impression—in new buildings or remodeling jobs—there's nothing like Modine Cabinet Units for *performance, styling, versatility.* Five smartly-designed models—120 to 640 Edr—offer an unmatched variety of installation arrangements and mounting possibilities for quiet, efficient, economical heat distribution.

Some can be used for steam or hot water heating . . . others heat with hot water . . . cool with chilled water. They can be installed upright or inverted . . . fully exposed, recessed or concealed . . . on walls, floors or ceilings. All can be used with or without ducts. What's more, with inexpensive accessories, Modine Cabinet Units can be adapted to introduce, filter, heat and distribute fresh outside air for ventilation. Above all, they're economical—cost far less to install than individual unit ventilators or air conditioners.

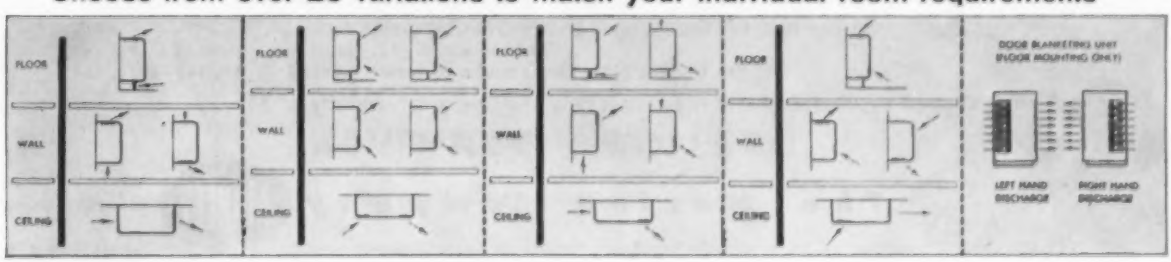
See the Modine representative listed in your classified phone book. Or write Modine Mfg. Co., 1509 DeKoven Ave., Racine, Wis., for Bulletin 552.

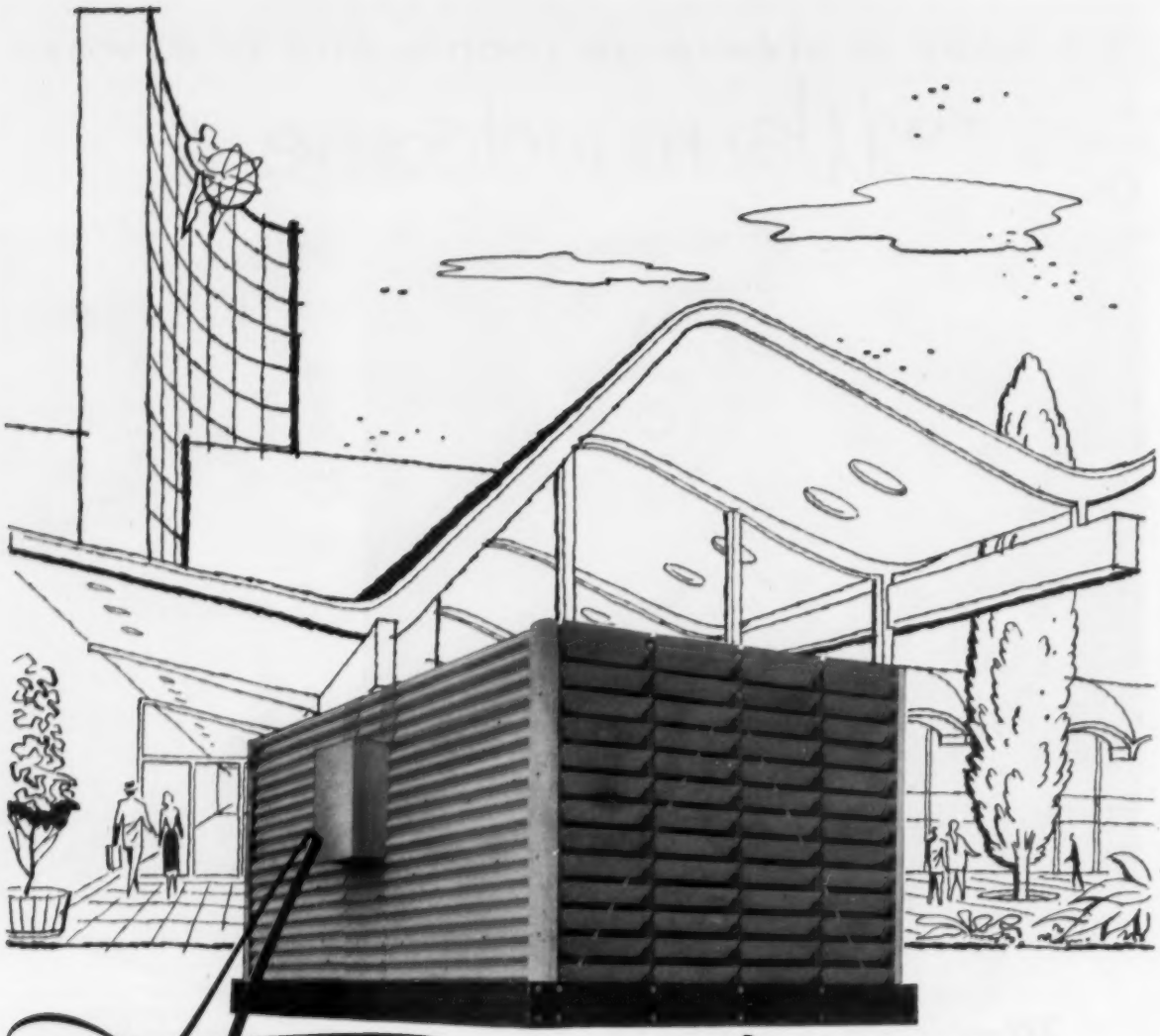
Modine CABINET UNITS

In Canada: Sarco, Ltd., Toronto

C-1315

Choose from over 20 variations to match your individual room requirements





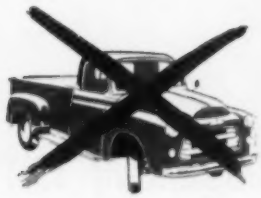
Advanced...

"Five years ahead of the field" – that is the expressed opinion of engineers and contractors who have unstintingly approved the low silhouette, high performance and rugged durability of Marley's Double-Flow Aquatower.

Small wonder, for this is the *original* low-silhouette tower for intermediate-capacity cooling – so original in design, so dominant in the quality of its components that it defies comparison. Even a cursory examination of its diffusion deck, fan, fill, and other functional elements stamps it clearly as the "Grade A" product in the field of institutional and commercial water cooling.

That the Double-Flow Aquatower is water cooling in a class by itself is attested by the fact that it is selected today for the great majority of all jobs that fall in its capacity range.

The Marley Company MARLEY Kansas City, Missouri



No service calls in 2 years with "*Cruising Speed*" operation

Kewanee Type "C" Boiler used in Canton High School. Corrugated crown sheet is self-cleaning, adds strength, effective heating surface. A compact boiler requiring less floor space, yet maintains high efficiency.
KEWANEE
reserve plus rated

Canton High School, Canton, Illinois
Architect—Atkins, Barrow & Lasswith (now Atkins, Barrow & Associates) Urbana, Illinois
Engineer—Consulting Engineering Service, Urbana, Illinois
Heating Contractor—Hays Plumbing & Heating Company, Urbana, Ill.

■ Canton High School votes experience the best teacher in selecting boilers...

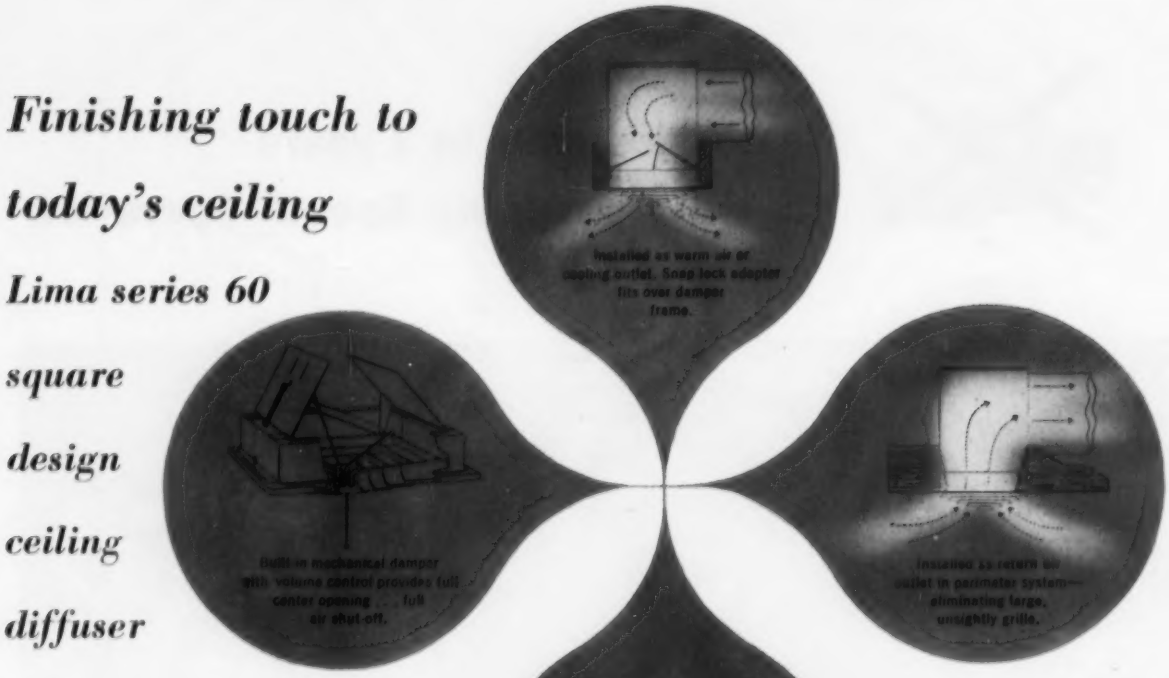
There's an old saying that goes like this... "Experience is the best teacher." The Canton High School, Canton, Illinois, prides itself on its fine academic teaching staff. But for knowledge of boiler operation, old "Dr. Experience" gets the call. So, when it came to selecting a boiler, school executives, the architect, engineer and contractor took a page from the past and chose Kewanee Reserve Plus Rated Boilers. Yes, experience proved Kewanee "cruising speed" boiler operation gave trouble-free performance with lower fuel and maintenance costs—higher efficiency, too. In 2 years there has not been one single service call. But that's easy to understand because "cruising speed" boiler operation guards against breakdown—there's less strain, less wear, higher efficiency, lower maintenance and fuel costs. And Kewanee reserve takes care of fluctuating demands and high power peaks, because Kewanee Boilers are rated on nominal capacity which guarantees 50% extra built-in power. Boilers rated on maximum capacity have no reserve to meet emergencies—must operate constantly at top speed—require more maintenance. So take a tip from those who have learned from experience and choose Kewanee Boilers. You'll be money ahead if you do. KEWANEE BOILER DIVISION OF AMERICAN-STANDARD, 101 Franklin St., Kewanee, Illinois.

KEWANEE BOILERS

You can depend on Kewanee engineering

Finishing touch to today's ceiling

Lima series 60 square design ceiling diffuser


Installed as warm air or cooling outlet. Snap lock adapter fits over damper frame.
Built-in mechanical damper with volume control provides full center opening . . . full air shut-off.
Installed as return air outlet in perimeter system—eliminating large, unsightly grille.

accentuates the beautiful symmetry of modern ceilings

When the specs call for a ceiling diffuser, you'll make your customer happier—and your job easier—by installing the Lima square design ceiling diffuser. It harmonizes beautifully with today's acoustical tile or block ceilings, and modern rectangular rooms. Light beige Lima finish is permanent and requires no repainting.

assures complete comfort in heating and cooling

The Lima-engineered square design and tiers of step-down vanes provide greater free area for more effective air diffusion in all directions at correct angles for complete indoor comfort—in heating and cooling. *Ask your jobber's salesman or write direct for new complete Lima catalog.*

Lima REGISTER COMPANY
LIMA, OHIO

Sold exclusively through heating wholesalers and manufacturers

Carrier packaged Water Cooling Machines now come in 18 sizes —from 3 to 200 hp

Now you can prepare to bid any chilled water air conditioning or process cooling job with full assurance that you can get packaged reciprocating equipment to fit.

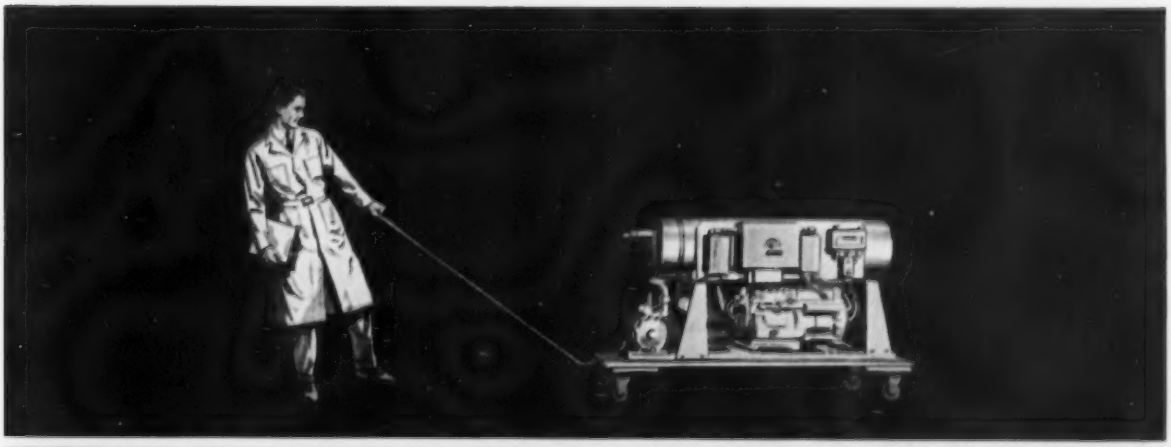
Carrier Water Cooling Machines come in 18 different sizes, offer you a complete range of capacities, from 3 to 200 hp. Models are available for use with water-cooled or evaporative condensers.

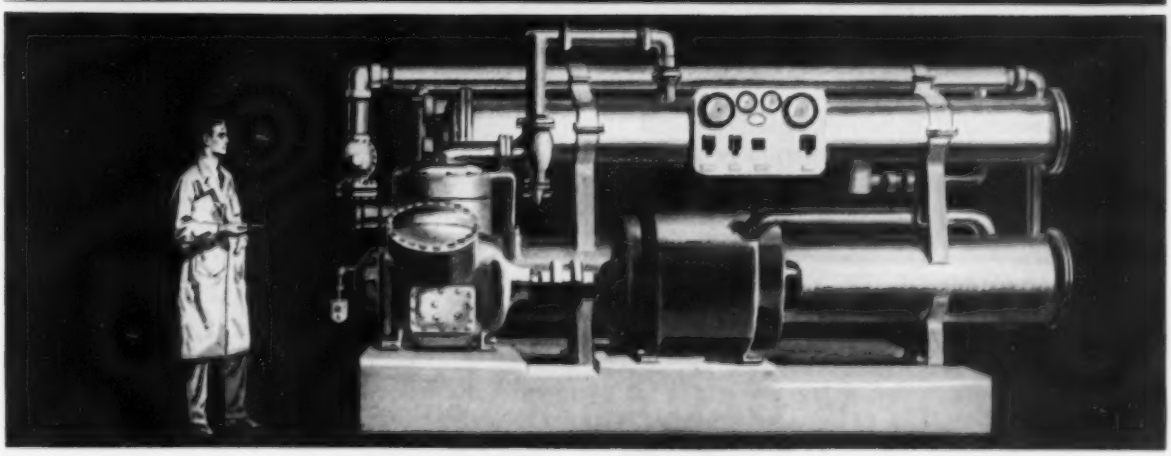
You can figure important time and cost savings, too. All interconnecting piping, valves and fittings are factory assembled. The units are so compact that most sizes fit through an average doorway.

And with Carrier, you have the additional advantage of exclusive compressor features—automatic reduced load starting and automatic capacity control on all models except small sizes. These mean substantial savings in motor and power costs.

Find out more about the Carrier Reciprocating Water Cooling Machines that meet all the requirements of chilled water systems. Call the Carrier Dealer or Branch Office listed in your telephone directory, or write Carrier Corporation, Syracuse, New York.

Carrier air conditioning • refrigeration • industrial heating



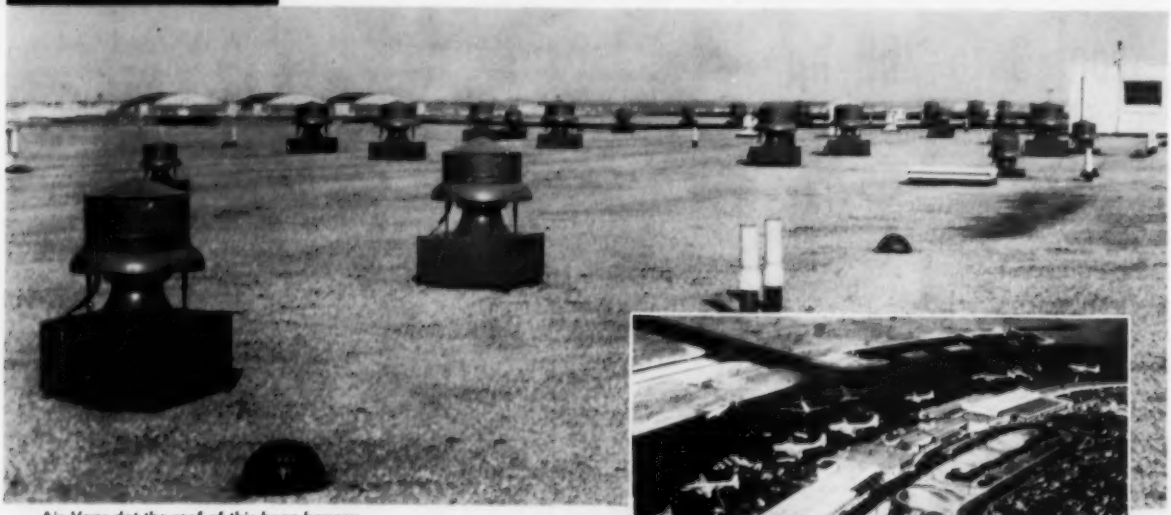


PROBLEM:

SOLUTION:

Positive ventilation of fumes from an aircraft hangar

26 Gallaher Air-Vans® assure safe working conditions in hangar #8 New York International Airport



Air-Vans dot the roof of this huge hangar

A partial view of New York International Airport

Elimination of carbon monoxide, removal of fumes from paint spray, removal of fumes from auto shop, air changing in the radio electrical equipment department—these are the kind of problems being solved by positive acting Gallaher Air-Vans at New York International Airport.

Solving problems like these is routine for Gallaher Air-Vans. Operation is efficient and uniform, assuring the safety of workers in Gallaher-ventilated buildings. Built-in scroll effect design assures the ventilation performance needed. The motor is out of the airstream and is protected by a patented air seal-off, for dependable operation.

Gallaher Air-Vans are specified by architects and engineers of public and industrial buildings everywhere for a number of reasons. They are available in special metals for special conditions. Air-Vans are shipped totally assembled, ready for installation, eliminating the expense of further assembly at the site. Air-Vans are quiet operating. Unit capacities range from 150 CFM to 65,000 CFM and up to 4" S.P. These ratings are certified in accordance with the procedures of NAFM.

For further information write

The GALLAHER Company

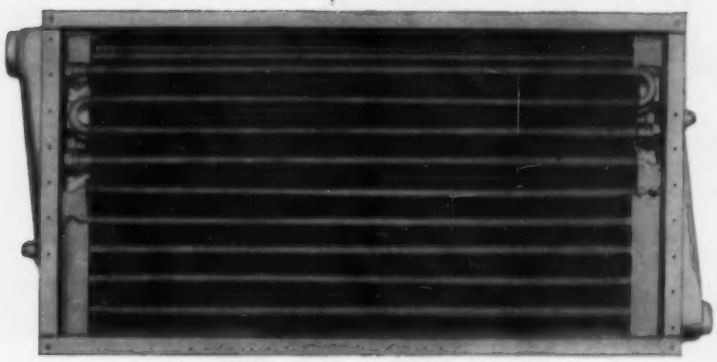
4108 Dodge Street Omaha, Nebraska

We Make

Extended-Surface

HEAT EXCHANGERS

Exclusively



The pioneer in the field, Aerofin has concentrated on one thing, *and one thing only* — highly efficient, easily installed, easily maintained extended-surface heat exchangers. Aerofin's design, research, engineering and production experience and facilities are unequalled anywhere.

For High Efficiency, Easy Installation, Low Maintenance and Servicing Costs . . .

Aerofin is sold only by manufacturers of fan system apparatus. List on request.

AEROFIN CORPORATION

101 Greenway Ave.,
Syracuse 1, New York

PROVED BY PERFORMANCE OF *OVER A MILLION* TRAPS!

YARWAY IMPULSE STEAM TRAP

the only moving part

...a small stainless steel valve that literally floats on the condensate load. Gets equipment *hot in a hurry—and keeps it hot!*

Using a theory of thermodynamics never before applied to steam traps, the YARWAY Impulse Trap revolutionized the industry *20 years ago.* Today over a million YARWAY traps have successfully proved the Impulse principle.

Advantages like the following continue to win new users, convince old users to standardize:

- **QUICK HEAT-UP AND EVEN TEMPERATURES OF EQUIPMENT**
- **GOOD FOR ALL PRESSURES WITHOUT CHANGE OF VALVE OR SEAT**
- **SMALL SIZE—LIGHT WEIGHT**
- **ONLY ONE MOVING PART**
- **STAINLESS STEEL—minimum maintenance**
- **WON'T FREEZE UP**
- **A COMPLETE LINE of sizes and types for every requirement**
- **IMMEDIATELY AVAILABLE from 270 local Industrial Distributors**

For free Trap Selector, or 24 page bulletin, write
YARNALL-WARING COMPANY 107 Mermaid Avenue, Philadelphia 18, Pa.

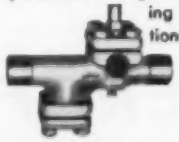
THERE'S A YARWAY IMPULSE STEAM TRAP FOR EVERY NEED

SERIES 60 and 120
For all *normal* trap requirements, pressures to 400 and 600 psi.

½" No. 20-A
For *light loads* on tracer lines, steam mains, small presses, etc.

SERIES 40
For *heavy loads* requiring extra high capacity steam traps

INTEGRAL-STRAINER HIGH PRESSURE TRAP
For *high pressures, high temperatures.* (Flanged or welding connections.)



YARWAY

IMPULSE® STEAM TRAP
OVER 1,000,000 YARWAY IMPULSE STEAM TRAPS USED

relaxing... playing... working

It's today's trend...

MODERN FAMILIES WANT WHITE-RODGERS... CONTROLS FOR MODERN COMFORT!

The active family of today needs dependable temperature control . . . all through the house. To meet their constantly changing requirements, depend on White-Rodgers "Controls for Modern Comfort." They're engineered for accurate, trigger-quick response to temperature changes, and to give W-R's famous extra-best in service!

COMPLETE, COORDINATED HEATING CONTROL SYSTEMS . . . engineered for easy installation, accurate adjustment and long, trouble-free service . . . using oil or gas as fuels . . . with warm air, hot water or steam as mediums.

WHITE-RODGERS *Controls for Modern Comfort*

HEATING • REFRIGERATION • AIR CONDITIONING

St. Louis 6, Missouri • Toronto 8, Ontario

an active thermal barrier against the outside elements

AIR-FACTORS INC

ACD

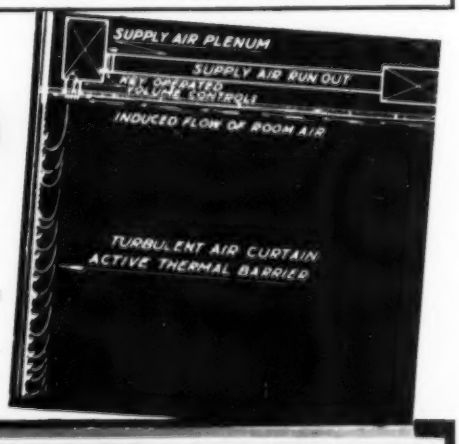
AIR • CURTAIN • DIFFUSER

FOR THE IMAGINATIVE ARCHITECT

An inconspicuous — neat appearing — mechanically effective AIR CURTAIN DIFFUSER for use with "Arcadia" type GLASS WALLS and sliding doors.

AIR-FACTORS series ACD incorporates all of the patented features of the unequaled LCF (Laminar Counter Flow) Air Diffuser.

Write for Literature and Engineering Data.



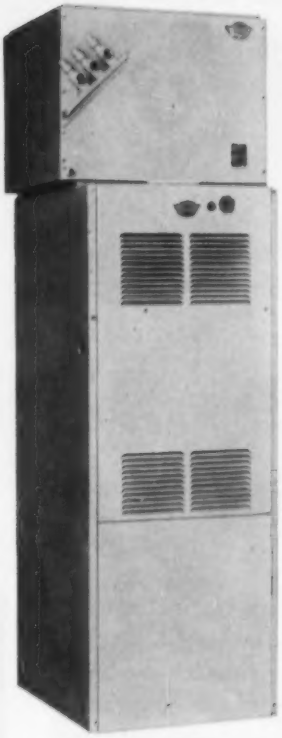
A-F AIR-FACTORS INC

1624 South Raymond Ave. Monrovia, California

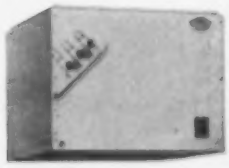
MANUFACTURERS OF MOST COMPLETE LINE OF AIR DISTRIBUTION EQUIPMENT

simple addition for air conditioning profits

REFRIGERATION
(condensing) UNIT
INSTALLS OUTSIDE HOUSE



AN UPRIGHT FURNACE WITH
EVAPORATOR ON TOP



COOLING
(evaporator) COIL
INSTALLS ON TOP OF FURNACE

Utility Weatheramic remote air cooled systems

Every home with any make of forced air furnace is a prospect for Utility's remote air cooled air conditioning units. They're easy to sell because they're economical and easy to install because they come with ⅜" pre-charged lines and tubing in 20 to 50-foot lengths.

Featuring extra-large blowers for greater cooling capacity, the condensing units come in Economy 2-ton, 2-ton, 3-ton and 5-ton sizes.

The evaporator units in 2, 3 and 5-ton sizes contain double (A-type) oversize evaporation coils adaptable to upflow and counterflow type furnaces.

Single coils for horizontal application in attic, basement or crawl space are also available.

Utility remote air cooled units are adaptable to all upright, horizontal and counter-flow forced air furnaces. With factory prewiring and other simplified installation features, you can add greater air conditioning profits by using Utility Weatheramic units.

Write for catalog data.

Weatheramic LINE UTILITY

FORCED AIR FURNACES/AIR CONDITIONERS

UTILITY APPLIANCE CORP.: Manufacturers of Utility Furnaces, Air Coolers, Air Conditioners, Water Heaters and Gaffers & Sattler and Occidental Gas Ranges

UTILITY APPLIANCE CORP. 4851 south alameda street, los angeles 58, california

CONTINENTAL

clears the air...

FOR THE ULTRAMODERN

LOUISVILLE POLICE HEADQUARTERS

LOUISVILLE POLICE HEADQUARTERS

Architects ..... Arrasmith & Tyler

Consulting Engineers ..... E. R. Ronald & Associates

General Contractors ..... Al J. Schneider Co.

Mechanical Contractors ..... Griffin & Company

One of the most modern and efficient police headquarters buildings in the nation, Louisville's new structure is air-conditioned throughout. To accommodate the special needs of the many different departments and facilities it houses, the air-handling system is divided into several separate zones. Five Continental Automatic Self-Cleaning air filters were installed to clean the 59,770 cubic feet of air per minute needed.

Exclusive patented honeycomb-type media, through self-flushing cleaning principle, and non-reversing curtain make Continental Automatics the outstanding choice for such installations.

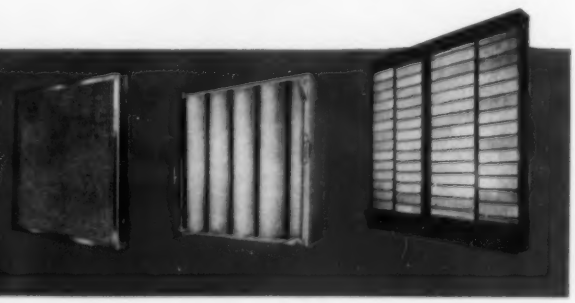
View of typical Continental Automatic Self-Cleaning Air Filters in Louisville Police Headquarters, showing drive mechanism open.

Air cleaning interest you?
Let Continental clear the air.
Write . . .

AIR CONTINENTAL FILTERS

P. O. BOX 1647 LOUISVILLE 1, KY.

CONTINENTAL AIR FILTERS Inc.



America's leading furnace manufacturers

hold out for the finest...

Cam-Stat fan and limit controls are first choice of nearly every leading furnace manufacturer! Individual or combination controls provide flexibility. Features and factory policy guarantee quality performance. That's why these controls, including "Decro-Stat," have: Two year guarantee; Precision calibrations and differentials —accurately maintained; Extreme sensitivity; Snap action switch— clean make & break.

CAM-STAT INCORPORATED

Division of the Paul Henry Company
11833 West Olympic Blvd. • Los Angeles 64, California

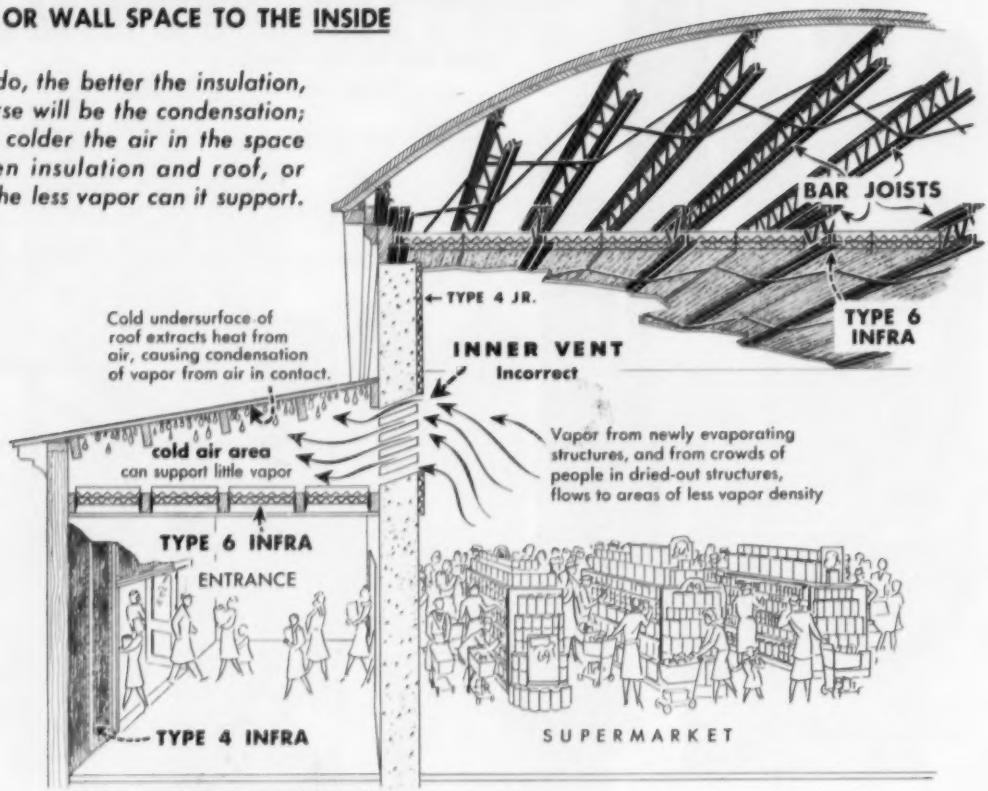
DECRO-STAT®

The new room thermostat that hides on the wall! Brushed stainless spring lid can be painted, wallpapered or even left "as is." Another leader from Cam-Stat.

NEVER VENTILATE

A CEILING OR WALL SPACE TO THE INSIDE

If you do, the better the insulation, the worse will be the condensation; for the colder the air in the space between insulation and roof, or walls, the less vapor can it support.


BAR JOISTS
← TYPE 4 JR.
TYPE 6 INFRA
INNER VENT
Incorrect
Cold undersurface of roof extracts heat from air, causing condensation of vapor from air in contact.
cold air area
can support little vapor
Vapor from newly evaporating structures, and from crowds of people in dried-out structures, flows to areas of less vapor density
TYPE 6 INFRA
ENTRANCE
TYPE 4 INFRA
SUPERMARKET

In a similar case, it was recommended that the inner vents above the insulation be eliminated

In new construction, moisture is evaporating from many tons of cement and plaster. Vapor flows from areas of greater density into this small, cold space, an area of less vapor density and small vapor capacity.

Where scientific multiple aluminum is used, fortuitous vapor and water (for instance rain) will gradually flow out, as vapor, through exterior walls and roofs as vapor pressure develops within. The vapor cannot back up through the continuous, almost impervious aluminum. It will flow out because walls and roofs have substantial permeability by comparison, far greater than the required 5 to 1 ratio. Infiltration under the flat stapled flanges of multiple aluminum is slight.

Unusual amounts of vapor, as from crowds in theatres, churches, schools, stores, etc. must be adequately vented to the outside. Each person breathes out and perspires vapor, winter and summer, at the rate of 3 lbs. a day.

To obtain MAXIMUM, **uniform-depth** protection against heat loss and condensation formation, it is necessary to use the new **edge-to-edge** multiple aluminum*, **each** sheet of which stretches from joist to joist.

*Patent applied for

The U.S. NATIONAL BUREAU OF STANDARDS has prepared a helpful and informative booklet, "Moisture Condensation in Building Walls" which discusses causes and cures. Use the coupon and we will send a free copy.

INFRA INSULATIONS CAN BE PURCHASED everywhere through your preferred local dealer for 3¢ to 12¢ per sq. ft. depending on the type.

Infra Insulation, Inc., 525 Bway., N. Y. C. Dept. H 8
Send "Moisture Condensation in Building Walls."

Name_____

Firm_____

Address_____

New Construction Will Break Record in 1956

. . . to reach $44½ billion

OUTLAYS for new construction are expected to total $44½ billion in 1956 — 4 percent above last year — according to the latest estimates of the Departments of Labor and Commerce.

These revised estimates reflect very little change in total construction activity from the $44 billion level projected for 1956 by these agencies last November. Compared with earlier expectations, new housing will decline more, but utilities, private industrial buildings, and highways, will show greater gains.

The present outlook assumes that the current high level of overall economic activity will remain relatively stable, and that disposable income of consumers will continue at record levels. Nationwide, supplies of building materials should be adequate, with increased plant capacity and high productivity preventing all but minor or spot shortages. Construction costs are expected to continue to rise moderately.

Prospects are that private construction outlays in 1956 will total about the same as in 1955—$31 billion. Public spending for new construction is expected to advance 9 percent to $31½ billion.

Private spending for new industrial plant expansion may reach the $3 billion mark, and new commercial building outlays probably will exceed $3.4 billion.

All other types of construction are likely to show at least a slight gain in 1956, except hospital construction, farm construction, and public industrial building.

Construction of public service enterprises is scheduled for a substantial advance, reflecting largely gains in work put in place on power and other facilities connected with the St. Lawrence seaway. Construction of public schools will probably advance to an all time high.

It is anticipated that expenditures for military facilities will continue to rise this year. Outlays for public housing are expected to increase for the first time in several years. ⧺

Book on "Sky Spirits" Is Air Conditioning Text

. . . translated into Japanese

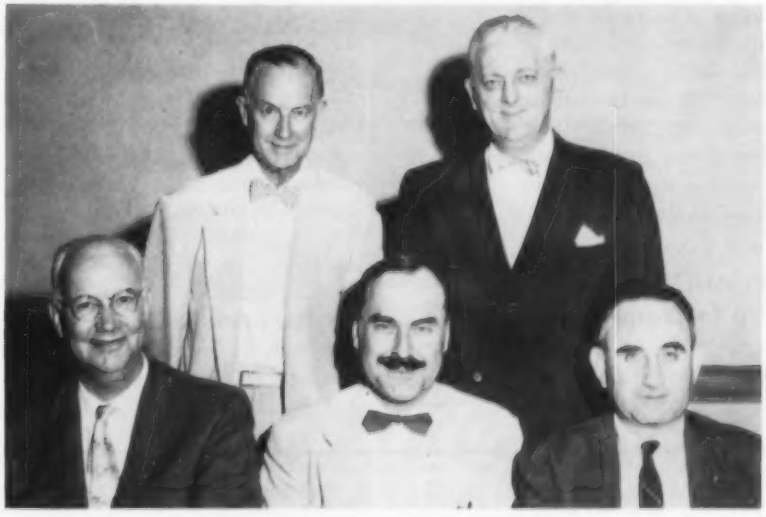
"LAWS for Modifying the Spirits of the Sky" is a technical book that has just been published in Japan, according to The Trane Co. That's a literal translation of the ancient ideographs that spell out the title. Actually, the book is a manual on air conditioning.

The Tokyo publication is a translation of the "Trane Air Conditioning Manual," which made its bow two decades ago in the U. S. The original was written by William Goodman, then a Trane staff engineer, who is now a consulting engineer and a member of HPAC's board of consulting and contributing editors.

With 23 printings in the U. S., 60,000 copies have been sold to engineers throughout the world. ⧺

Consulting Engineers Form National Council

. . . to correlate work



A NATIONAL Consulting Engineers Council has been organized to correlate the work of state and regional associations and to promote the professional and economic welfare of members. Organization took place last month at a convention in Tulsa, Okla., after a year of planning, which included drafting a constitution.

Officers elected — see photo — are, left to right, 1st row: Charles C. Pate, Tulsa, 1st vice president; John K. M. Pryke, New York, president; Bernard Dornblatt, New Orleans, 2nd vice president; 2nd row: William C. Becker, St. Louis, treasurer; and Edward J. Wolff, Chicago, secretary.

"Christmas in July" Marks Air Conditioning

. . . at leading hotel

"CHRISTMAS in July" was celebrated by the Palmer House, Chicago, last month to draw attention to its air conditioned rooms. The hotel's Town & Country cocktail lounge, decorated with evergreens, lights, and ornaments, featured Christmas drinks. A Santa Claus in red Bermuda shorts played host.

An easel sign in the hotel arcade urged the passer-by to "forget your warm weather cares and hurry down to the cool Town & Country party called 'Christmas in July'" where all month they featured special yuletide drinks and old fashioned holiday fun. "All to celebrate," the sign went on to say, "the fact that the Palmer House now has 1735 air conditioned rooms . . . more than any other hotel in the world." ⫩

Plastic Pipe Standards Up for Approval

. . . include two types

COMMERCIAL STANDARDS for dimensions and tolerances for rigid polyvinyl chloride pipe and solvent welded cellulose acetate butyrate pipe have been recommended by the commodity standards division of the U. S. Department of Commerce.

Both specifications were proposed by the Society of the Plastics Industry and have been adjusted in accordance with comment from other interests. If they are endorsed by a satisfactory majority of the industry, they will be issued by the Department of Commerce as commercial standards for voluntary use by the industry.

Copies may be obtained from F. W. Reynolds, Commodity Standards Div., U. S. Dept. of Commerce, Washington 25, D. C. ⫩

K. E. Robinson Joins HPAC's Editorial Board

. . . industrial ventilation expert

WE TAKE pleasure in announcing the appointment of Kenneth E. Robinson to HPAC's board of consulting and contributing editors. Mr. Robinson, ventilation engineer in the industrial hygiene department, General Motors Corp., is consultant to plant engineers of the various GM divisions on industrial ventilation problems.

He has had more than 20 years of experience in the industrial ventilation field. He was chief engineer for Dail Steel Products Co. in Lansing, Mich. In 1943 he joined the division of occupational health of the Michigan department of health to organize their section on industrial ventilation.

Mr. Robinson was instrumental in the development of the sound film "Industrial Exhaust Hoods" available from the University of Michigan, which has been translated into many foreign languages for teaching throughout the world. He served as chairman of the committee that formulated the Industrial Ventilation Manual and was active in originating the Industrial Ventilation Conference which is held at Michigan State University each year in February.

At present he is a member of the ASHAE technical advisory committee on industrial environment, chairman of the engineering committee of the American Industrial Hygiene Association, and is on several committees of the American Standards Association and the American Foundrymen's Society. ⫩

Seek to Strengthen Air Pollution Control

. . . in Chicago

STRONGER MEASURES to control air pollution in Chicago were recommended recently to Mayor Richard J. Daley by Thomas H. Carey, director of the department of air pollution control, according to Illinois Institute of Technology.

Recommended changes in the air pollution code include:

- Formation of an air pollution policy and appeal board.
- Enforcement based on performance rather than specification.
- Increase in fines for repeat offenders.
- Licensing of personnel dealing with plants and processes tending to emit pollutants.
- Extension of control to additional air pollution sources.

The recommendations were made to the department of air pollution control by the Midwestern Air Pollution Prevention Association, which was asked to suggest measures to strengthen abatement laws. ⫩

"QUOTE"—

True air conditioning provides comfort in all seasons of the year. A simplified definition of air conditioning prepared and adopted by the American Society of Heating and Air-Conditioning Engineers was announced by the society's president, John W. James, at the recent semi-annual meeting in Washington:

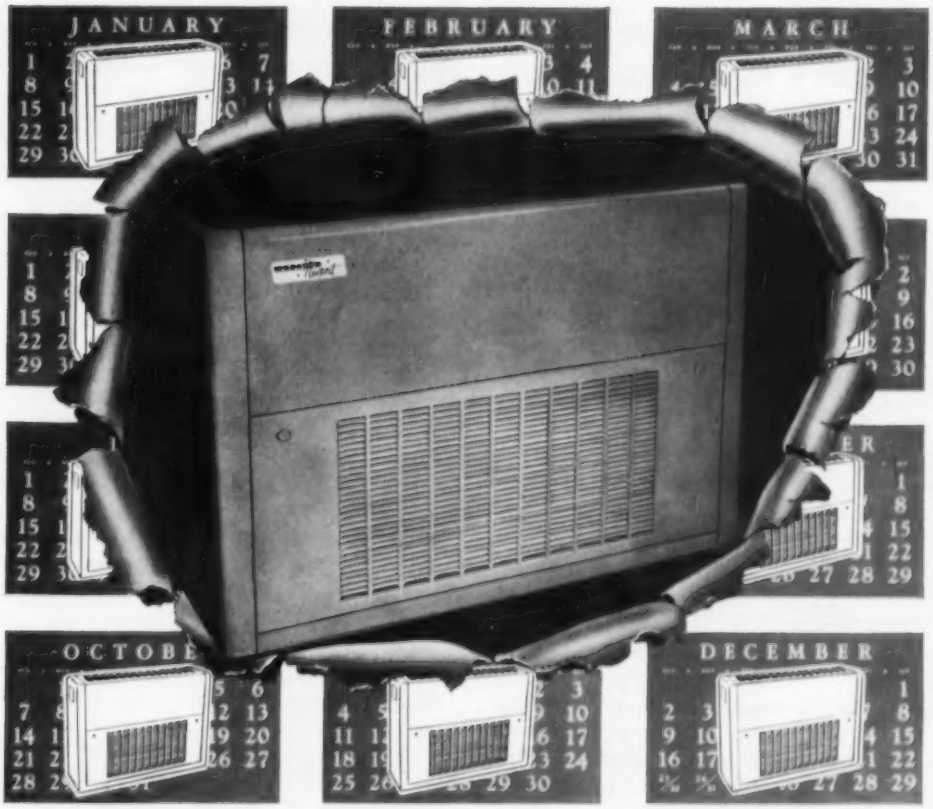
"Air conditioning is the process of treating air so as to control its temperature, humidity, cleanliness, and distribution to meet the requirements of the space."

The ALL-NEW

WEBSTER Newport

- ★ Economical through-the-wall units... no blocking of windows
- ★ Ideal for hotel, office building, apartment or motel modernizing
- ★ Easily installed without loss of overnight revenue
- ★ Ties into any present steam or hot water heating system . . . air-conditions the year 'round

for all-season heating and cooling



Out go the radiators . . . in come these modern, compact, practical cabinet-type units to complement any interior, bring new appeal to every room. Connects to the present piping system. Completely self-contained, hermetically sealed cooling cycles require no water, no cooling towers.

For more of the exciting details about the all-new Webster Newport, see your Webster Representative or write for bulletin. Address Dept. HP-8.

WARREN WEBSTER & COMPANY
Camden 5, New Jersey

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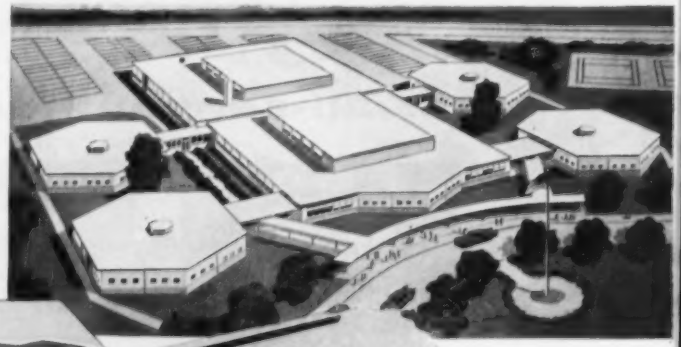
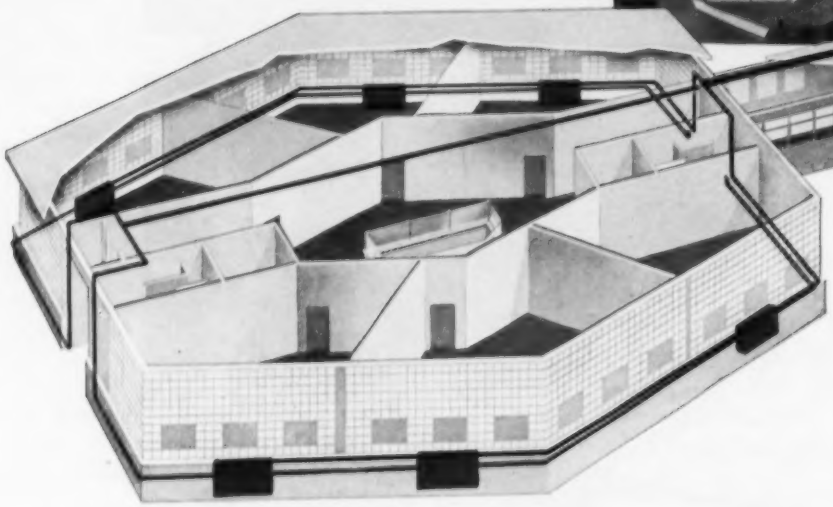
PROOF...

More Learning per School Dollar

through use of the Nesbitt Series Hot Water Wind·o·line System

This Nesbitt heating and ventilating system, with automatic temperature control, was installed in Lakewood High School at a cost of *$1.38 per square ft. of floor area!*





Lakewood High School, Lakewood, N. J.
Micklewright & Mountford, Architects
John Knecht, Mechanical Engineer
Maximum Capacity: 1000 pupils
Functional Capacity: 800 pupils
Gross Area: 86,240 square feet
Heating Contract: $118,787.00
Total Cost: $1,030,533.00

THE specification of the Nesbitt Series Wind-o-line System for Forced Hot Water Heating at Lakewood High School saved 2,400 feet of pipe trenches and 2,900 feet of additional mains and pipe covering when measured against a conventional steam system.

The Nesbitt Series Wind-o-line System effects these savings through the use of a unit ventilator radiator that delivers the required amounts of heat by multi-passing only one-third the usual amount of water—but at higher temperatures than is circulated by conventional hot water systems. This reduces the pipe size requirement to where the copper tubing of Wind-o-line Radiation can serve as the only supply and return piping for all the unit ventilators in an entire classroom wing, thus eliminating the need for mains, costly pipe trenches, coverings, and individual runouts to each unit.

Moreover, smaller water quantities mean smaller, less expensive pumps—with lower operating costs. And because the gravity heating effect of Wind-o-line Radiation and the Syncretizer radiator is sufficient to maintain overnight classroom temperatures, the cost of additional controls and equipment for that purpose is eliminated.

The Nesbitt Series Wind-o-line System means *greater comfort*, too! Since the system water temperature is varied by outdoor temperature, Wind-o-line's protection against cold surfaces and window downdrafts is continuously related to actual needs — helping to create the thermal environment most conducive to learning.

Nesbitt Heating and Ventilating offers you
MORE LEARNING PER SCHOOL DOLLAR
Write for further information

Nesbitt

SERIES WIND·O·LINE SYSTEM

Manufactured and sold by John J. Nesbitt, Inc., Philadelphia 36, Pa.

Sold also by American Blower Corporation and Canadian Sirocco Co., Ltd.

"Open for Discussion"

• *WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

Why Only Insulate Under Feeder Ducts in School's Warm Air Heating Systems?

IN THE ARTICLE, *Forced Warm Air Heats New School*, in the June HPAC, Fred S. Dubin shows how forced warm air heating can be used to satisfy both the comfort and ventilation requirements for a school with one air distribution system. Furthermore, his design exhibits a high degree of ingenuity in that he is able to satisfy separately the heating requirements of seven individual rooms, each with distinctly different thermal load characteristics.

This is the essential consideration in the problem. Each room has large glass areas which are subject to both solar heat gains and rapid responses to changing weather conditions during the winter. Two of the seven rooms have three exposed walls, and two others have two exposed walls. This is in contrast to more common building designs in which there are usually no less than two adjacent rooms with the same number and direction of exposed walls and approximately the same glass and wall areas and internal loads. In such cases, problems such as zoning and system layout become less complex.

The ingenuity used in the design of the individual room systems does not immediately strike the reader. A case in point is the system used for each of the corner rooms having three exposures. In these rooms, the modified perimeter lateral distribution system apparently does three things: it provides embedded supply ducts for warming the floor on all three exposures; air is introduced into the room along two of the exposures, presumably under small windows on one side and large windows on the other; warm air is delivered to the perimeter diffusers underneath the large windows in such a way that length of the embedded ducts along the perimeter is at a minimum, and the temperature drop is therefore also a minimum. Similar considerations undoubtedly entered into the author's thinking in the design of the systems for the other rooms.

It is inevitable that questions concerning the design arise. Why, for instance, was a moisture barrier used only underneath the supply ducts instead of underneath the entire floor? Many authorities consider that such a barrier should be placed between the noncapillary fill and the slab in all areas. Why did the author decide that it was necessary to place insulation only underneath the feeder ducts? Perhaps his experience has shown that neither excessive floor surface temperature nor duct air temperature drops occur when feeder ducts are not surrounded by insulation or insulating concrete. Information on these points would be of interest.

The importance of the closing paragraph of the article cannot be over-emphasized. Cooperation among contractors is essential whenever the heating system is to be embedded within a concrete slab floor, regardless of the type of building involved. It should be axiomatic that no one contractor or trade can perform its mission satisfactorily if its problems are not recognized and appreciated by the others involved on the job. Unfortunately, only where special efforts are made to achieve this type of cooperation does it actually exist.

HERBERT T. GILKEY
Technical Secretary-Research
National Warm Air Heating
and Air Conditioning Association

THE AUTHOR REPLIES—Mr. Gilkey has aptly described some of the problems which we faced in our method of solution in heating and ventilating this unusual school. The questions which Mr. Gilkey has raised are pertinent. We feel it is especially important that a moisture barrier be placed beneath all underfloor ducts in order to minimize heat loss from the ducts, and to protect the duct material. This is especially important if fiber ducts are to be used. On our projects we insist that the heating contractor concern himself, along with the general contractor, with the proper installation, preparation, and protection of all underfloor ductwork. For this reason the moisture barrier beneath the ducts appears on heating plans. The architects felt that no moisture barrier was needed beneath the entire floor slab because of good drainage which existed. We feel it is highly desirable in all cases to have a moisture barrier below all slabs which are placed on grade.

In our experience we have found it to be important to insulate below supply ducts in order to minimize differences in supply air discharge temperatures from these ducts in rooms which are at varying distances from the furnace. The control and operation of the entire system is greatly improved by equalizing supply duct discharge temperatures. The total amount of heat lost from return air ducts is not serious. Since all return ducts are extended into a common plenum chamber at the blower inlet, temperature differences in the return air duct system are not important. The heat lost can be compensated for by increasing the amount of heat delivered to all supply ducts equally in the furnace bonnet.

We have not found that excessive floor temperatures occur over uninsulated supply ducts. Actually we recommend insulating only the lower portion of the supply ducts in order to minimize the downward loss, and to

allow the upper portions of the duct which are in contact with the slab to deliver some heat to the floor slab within the room that is being heated. Incidentally, the architects, whose name was not mentioned in the article, — The Architects Collaborative — were exceptionally cooperative with the engineers in the design of the heating system.

FRED S. DUBIN
Fred S. Dubin Associates
Consulting Engineers

Need to Evaluate Standardization Data On Steam, Electrical Pipe Line Tracing

I WOULD LIKE to comment on the article, *Use Steam or Electrical Tracing for Pipe Lines?*, by Lee P. Hynes in the May HPAC. My comments are numbered to correspond to the article's questions with the same numbers.

3) For spiral wrapped tubing, an oversize insulation may be used, but some applications show a wrapped blanket over wire mesh which would seem expensive to install. Three such methods are:

a) Oversize prefabricated insulation section such as snap-on glass fiber or other type.

b) Wrap around glass wool or mineral wool with wire mesh below for rigidity.

c) Two-layer insulation with the first layer cut to allow tracer to be insulated.

Discussion of the merits and advantages of these three methods would be interesting, both from an operational and an economy viewpoint.

4) Average costs tend to even out differences of ground conditions, etc. Figures can be arrived at from transmission lines on the basis of man hours per 100 ft of pipe considering a definite number of fittings per 100 ft of pipe. An "*N*" factor can then be applied for more or fewer fittings per 100 ft. Separate cost figures would be given for indoor and outdoor lines, as the latter must be weatherproofed. By keeping estimates in man hours with respect to the labor factor, it makes the figure more valuable nationwide. Material costs need to be kept up-to-date with an index.

5) A tabulation of tracer size vs heated line size for various diameters should be possible.

6-b) This method has worked best for us. We use lead covered cable, spiral wrapped and insulated with the best felt laminated insulation with a ¼ in. layer peeled out of the inside. We use them on a 440 volt, three-phase system, with the terminals and thermostats enclosed in weatherproof boxes and attached to pipe support columns. In three and a half years of operation, we have had no maintenance on these circuits, and access to the terminals is simple, with no interference with the insulation of the pipe. This type compares favorably with steam tracing even in initial installed costs.

c) This would seem to us a very costly method of electrical tracing. We would consider steam tracing more economical if this type had to be used or if heat needed was too great to be supplied by the heating cable method.

7) It is obvious that low points will introduce additional steam trap points. We would like to know how often a straight run of pipe should be trapped for spiral and parallel tracing, for various size lines. At some point, a given size steam tracer will become so full of condensate that its ability to protect the line is decreased. This would seem to indicate a maximum distance between traps for a given steam tracer size with a given pitch to the traced line and tracer. Two figures would be needed, one for spiral tracing and another for parallel tracing.

8) My comment on 8 is the same as for 4 above.

Apparently the lack of correlated and evaluated estimation and standardization data—or available data —is widespread. This is a challenge to publications like yours. I think you have one of the best, but it could go further in this cost estimation and standardization.

RALPH H. CUSHING
Chemical Engineer
Bristol Laboratories, Inc.

Warm Air Envelope Acts as Heat Barrier To Body Radiation to Cold Outside Walls

WELL TAKEN are the comments of E. K. Campbell in the April HPAC on my article, *New Church Heated by Large Sub-Floor Duct System*, which was published in the September 1955 HPAC. They amplify one concept that was evaluated and incorporated in the basic design of the church's heating system, namely that of sufficient air changes to minimize stratification.

The system described in my article was based on the concept of establishing a warm air envelope to act as a thermal barrier to body radiation to cold outside walls. Coupled with this basic requirement was the introduction of some conditioned outside air to freshen the atmosphere and to make up air exhausted from the toilets, etc. In addition, the amply sized pressure relief dampers did relieve the builtup pressure.

Air stratification was prevented by the panel heating effects of the underground distribution system and the warm air curtain on the outside walls, which prevented the greater mass of cold air from ever being permitted to fall to the floor. High velocity air could be used to disperse this cold air but only after it made its presence felt to the occupants further aggravated by the drafts caused by the dispersion.

Finally, by scrubbing the outside walls with warm air we eliminated the discomfort due to body radiation to cold surfaces, permitting the temperature setting to be reduced approximately 5 F with no discomfort to the occupants. We still maintain that heat should be replaced where heat loss occurs — namely the shell of the structure.

BASIL A. KOSARIN
National Heater Co., Inc.
Arnold A. Kosarin & Associates

what they're saying about REVERE COPPER WATER TUBE

"There's nothing like it for running refrigeration lines, for economy and for ease of installation." says, William N. Harris, President
WILLIAM N. HARRIS, INC.
Pawtucket, R. I.

Architects: ESHBACH, PULLINGER, STEVENS & BRUDER. Consulting Engineer: A. ERNEST D'AMBLY, both of Philadelphia, Pa. Revere Distributor: R. I. REFRIGERATION SUPPLY COMPANY, Providence, R. I. Above photo shows compressor line-up in this 65-ton-capacity refrigeration layout. When you consider how long it would have taken if all the piping connections on this job had to be threaded, then you can readily understand why architects, contractors and engineers use Revere Copper Water Tube with soldered or brazed joints.

"As a refrigeration contractor I've found that nothing equals copper water tube for refrigeration and air conditioning lines. You can work in the tightest corners because the solder or brazed joints you make need no wrench room and you never have to worry about rust clogging the lines when you use copper tube. And because copper tube always makes a neat installation and is bright and shiny, you need never worry about exposing it. All things considered, copper costs less to install, too."

The words may be different, but we keep hearing the same saving story again and again. So why take chances? See your Revere Distributor for your copper water tube needs. And if you have technical problems, ask him to get in touch with our Technical Advisory Service for you.

Above photo shows insulated copper tube supply and return lines connecting cooling tower to compressors in Shore's Supermarket, East Providence, R. I. 2,500 FEET OF REVERE COPPER WATER TUBE in sizes from ½" to 3" were used. Refrigeration included storage room for frozen foods and meats, counter storage and sales areas.

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

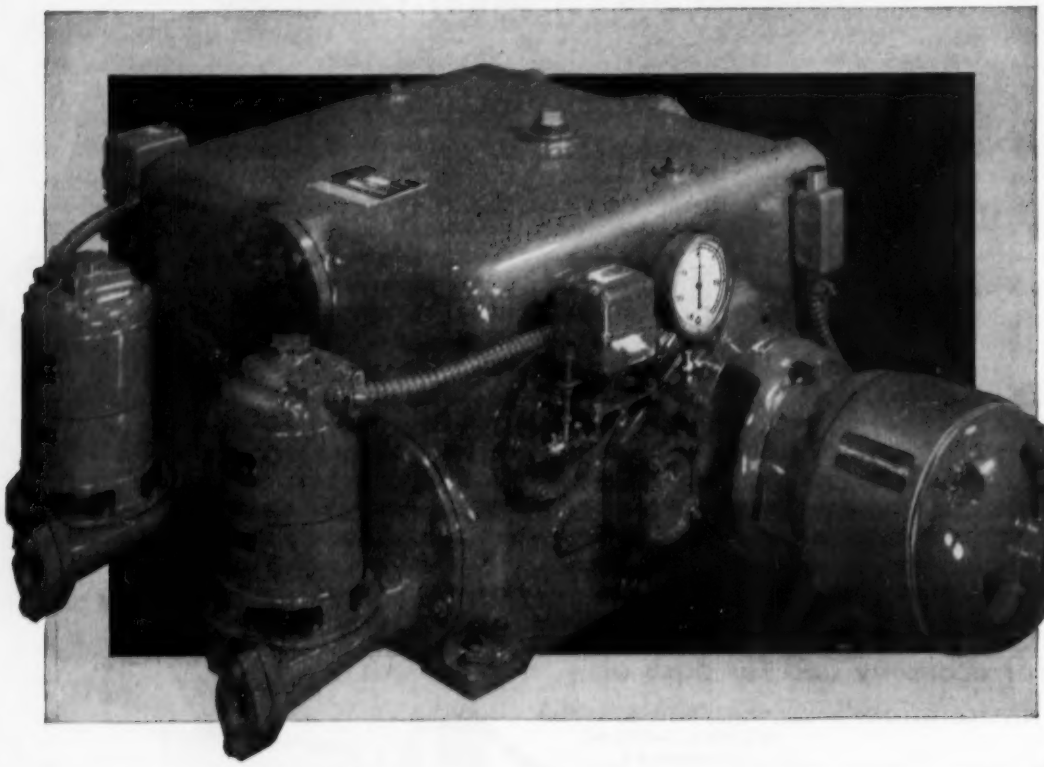
230 Park Avenue, New York 17, N.Y.

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

COPPER • BRASS • 1801 • REVERE • ALUMINUM

THIS NEW VACUUM HEATING PUMP

HAS THE INCREASED AIR CAPACITY EFFICIENT HEATING PRACTICE DEMANDS



It's the Nash CSM

Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
437 WILSON, SO. NORWALK, CONN.

1900 Ton System...

. . . costing $3 million and utilizing two steam driven centrifugal compressors, replaces 150 tons of existing equipment in 22-story Manhattan landmark. . .

1 FAN-COIL UNITS under windows heat and cool top 11 floors of Cunard building. Furred column, center, contains risers. Ventilation is provided by an interior duct system, which also heats and cools interior spaces

...To Condition 35 Year Old Building

By Edward Deeb and **Maxwell Malkiel**

Project Manager **Mechanical Engineer**

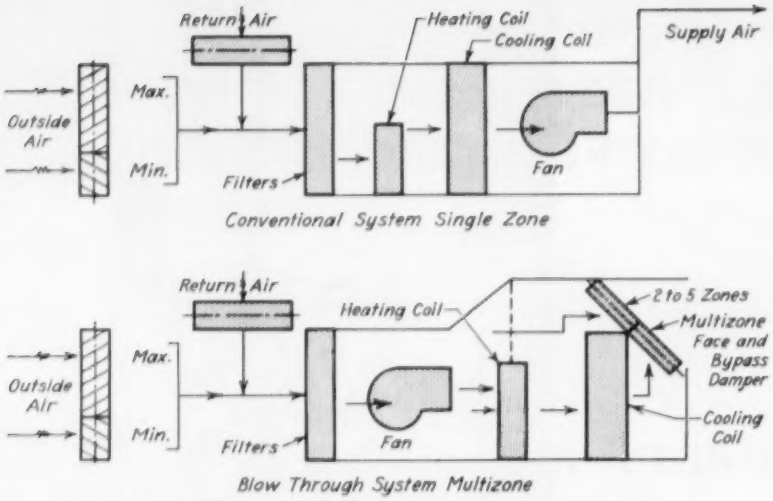
Kerby Saunders, Inc., Mechanical Engineering Contractors

Conventional air handling units — either straight single zone type or blowthrough type serving several zones — are installed on the first 11 floors. The upper stories employ a split system, using fan-coil units at the windows and conventional units for ventilation and interior areas.

Primary chilled water is pumped to all fan rooms and window units from the sub-basement equipment room. To limit expansion in the risers, which also convey hot water, intermediate anchors are installed between risers and short runouts on each floor, as well as bellows type expansion joints.

THE RECENTLY air conditioned, 22 story, 35 year old Cunard building, New York City, houses over 100 tenants in its 580,000 sq ft of space. In lower Manhattan, the building is owned and operated by the Twenty-Five Broadway Corp. At the third floor level the structure sets back to form an "H" pattern, with open ends facing north and south.

It had 150 tons of air conditioning equipment installed in various



2 AIR HANDLING SYSTEMS utilize minimum and maximum outside air and return air automatic dampers, cleanable filters, nonfreeze preheat and six row water coils

locations when the building management decided to completely air condition the entire structure.

The new air conditioning system, which cost $3 million, is a 1900 ton central refrigeration system, with primary chilled water distribution to all fan rooms and window units throughout the building. Up to and including the 11th floor, conventional air handling units supply the entire cooling load. Above the 11th floor a split system is employed, using fan coil units at the windows and conventional units for ventilation and interior areas. All systems are designed to maintain 80 F dry bulb and 50 percent relative humidity in air conditioned spaces when outside conditions are 95 F DB and 75 F WB.

Utilize Existing Ductwork

Conventional air handling systems are of either straight single zone or blow through types. Both utilize minimum and maximum outside air and return air automatic dampers, cleanable filters, nonfreeze preheat and six row water coils. The two systems differ only in the location of the fans and the addition of face and bypass automatic dampers to the blow-through units, as shown in Fig. 2. Control of the single zone units is by a room thermostat which modulates a three way valve on the water coil. Room thermostats for the blow-through systems modulate face and bypass dampers off the water coil for each zone. During summer operation, the maximum outside air dampers are closed and chilled water is circulated for all cooling. Cooling for the "in between" season is by means of modulating the maximum outside air damper, with the return air damper to give desired leaving air temperatures. At this time the three way valve bypasses chilled water. To prevent overcooling, the control valve on the preheat steam coil opens to maintain necessary temperatures. For full winter operation, the maximum outside air damper is closed; hot water is circulated through the water coil; the steam coil is operated for freeze protection and preheat if necessary; and room thermostats for both systems reverse action and modulate as before. The existing radiator system remains in use for winter heating.

Below the fifth floor, the center of the building is cored out to form the Great Hall. This area measures 185 ft by 50 ft and soars into a great dome 80 ft high. The apex of this dome ends in a plenum covered by a huge gold rosette. Existing ductwork is used in connection with new air conditioning equipment to supply the plenum with conditioned air. This air flows down through the dome which acts like a huge diffuser. Because of the great hall and other architectural considerations, it was necessary to use 11 separate systems to supply conditioned air to all floors and zones below the fifth floor. These 11 systems are field built units and all are dimensionally tailored to fit available space conditions.

The fifth through the 11th floors are served by identical units each handling approximately 35,000 cfm of conditioned air. Twin fans connected by a flexible coupling and driven by one 25 hp motor are used. This was necessary because the size of a single fan prohibited its use. Design for these floors called for five separate zones which together with the amount of air handled dictated the use of a field built unit.

Split System On Upper Floors

As previously mentioned, the split system contains both conventional air handling units and perimeter fan coil units.

The conventional air handling systems are similar to those used below the 12th floor and are of the single zone pull through type. These air conditioning units are controlled by a thermostat at the return air intake. One difference is that the minimum outside air damper handles 80 percent of the 10,000 cfm of conditioned air delivered since the unit supplies the entire floor with necessary ventilation. The units, of the horizontal ceiling hung type, permit a 6 ft clearance for floor space below. Commercially available, factory built units are used for this application.

The fan coil units at the building perimeter are under the windows and serve the exterior zones. Each floor has approximately 100 window units installed, giving a total for the building of 1083 for the 12th through 22nd floors. Since the design for the selection of these units calls for an effective area 18 ft in from the outside wall, most of the floor sensible heat is absorbed at the perimeter.

Control of the window unit is effected in two ways. One is by means of a three speed fan switch which adjusts cfm output. The other is through use of a return air bulb, hand set

thermostat on the unit. This thermostat modulates a control valve on the water coil. Where groups of up to five units are used to condition the same area, one thermostat controls all the valves. Over 550 of these thermostats are installed for the 12th through 22nd floors. Summer operation calls for chilled water circulated through the coils. During "in between" seasons, when cooling is still necessary due to internal loads, and although outdoor temperatures are low, chilled water is still required since no outside air is supplied at the unit. This compares at a disadvantage with the systems on the lower floors, where it is possible to use 100 percent outdoor air to take the cooling load. For full heating the thermostats reverse action on the window units and hot water is circulated through the coils.

Pumps Are Non-overloading

All refrigeration equipment and main pumps are in the sub-basement. Refrigeration is supplied by two steam turbine driven centrifugal compressors of 930 tons each. Three 60 hp pumps supply chilled water, each handling one-third of the total 4500 gpm circulated. Three 75 hp condenser water pumps handle a total of 5580 gpm. An additional 75 hp pump handling 1860 gpm is manifolded to both chilled water and condenser water cycles and acts as standby. All pumps are horizontally split, centrifugal units, with mechanical seals and flexible couplings attached to motors on a single baseplate. In all cases the motor horsepower selection gives non-overloading operation for any position on the pump curve. Chilled water as well as condenser water pumps are arranged to pull through rather than pump through in order to reduce the working pressures on the discharge side.

The base construction for all pumps consists of a 2 in. iron bound cork on a 4 in. high concrete pad. Each pump's baseplate is bolted to a 16 in. high concrete block resting on top of the cork. This type of construction shows remarkable damping effect and gives quiet operation.

A condensate cooler and steam hot water exchanger are also adjacent to the refrigeration equipment and are mounted in series on a line off the primary water circuit. For winter operation the refrigeration machine is bypassed and valves are open to the condensate cooler and heat exchanger to supply the primary system with hot water.

Also in the refrigeration machine room are the turbine auxiliaries, the condenser and hot well pumps, together with turbine casing drain tanks. The main temperature control panel board, two 10 hp air compressors, and the main electric control and starter panel complete the layout. The electric panel contains the starting equipment for all basement equipment, main pumps, cooling tower fans, and makeup water pumps.

An unusual feature of the control board is the use of an electronic start-stop system which automatically controls all fans and window units in the entire building. At a given time in the morning, the transmitter sends signals out on one of four high frequencies which is superimposed over the regular 110 volt a-c lighting circuit. Twenty-four receivers, six on each frequency, are installed throughout the building, each coded to receive a separate signal impulse. The receiver then operates a relay which energizes the holding coil circuit in the magnetic starter of one or more pieces of equipment. Within 12 minutes all equipment is operating. A test impulse is sent out by the transmitter every 10 minutes and indicator lights flash the status of the equipment. This usually enables the engineer to arrive at the sources of the trouble before complaints are received from the office manager.

Pipes Rise in Elevator Shaft

Two 16 in. lines carry primary water from the sub-basement machine room to the main risers in an ex-elevator shaft. The top of the shaft was opened to admit outside air through the addition of a penthouse intake. Primary water, steam, and return lines enter at basement level and rise 22 stories to service air handling equipment adjacent to the shaft.

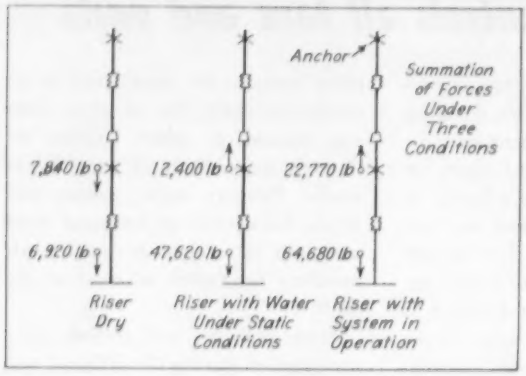
Since both hot and chilled water are supplied during the different seasons, considerable expansion occurs in the primary risers. The proximity of equipment rooms to the shaft necessitates short runouts which absorb only a small amount of deflection.

In order to limit the expansion in the risers, intermediate anchors are installed with expansion joints. The bellows type is used because of the inaccessibility of the joint for maintenance after installation. This type of expansion joint gives rise to varying reactions at the intermediate anchors. Although the dry riser results in downward forces on the anchors, a reversal in force is felt when the riser is filled with water, particularly when pump head is added. The tendency to lift the pipe off its support is greatest when the system is operating. For some design data used for the risers, showing the magnitude and direction of the reactions used in calculating the anchors, see Fig. 3.

The equipment served by the primary risers includes all central air handling units together with the secondary water machine room on the 11th floor.

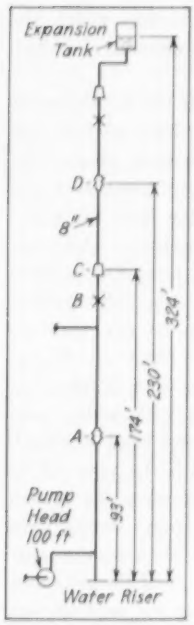
How Five Zones Operate

Five zone systems with a standby unit are on the 11th floor just off the primary shaft. A typical system, shown in Fig. 4, includes a booster pump, heat exchanger, three-way and two-way primary water valves together with steam control and water relief valves. Cooling operation calls for modulating three-way and two-way valves to provide design chilled water supply temperatures. These



3 RISER EXPANSION AND REACTION, as a result of downward and upward forces, is greatest when system is operating. Intermediate anchors with bellows type expansion joints limit expansion

How pipe forces were calculated



To find the maximum force at the base, add all forces acting between point *A* and the base, which include: 1) the weight of the pipe; 2) the water pressure at the base; 3) the force due to the water pressure at the expansion joint; and 4) the force due to expansion stresses in the expansion joint.

1) Weight of 16 in. Schedule 30 pipe ..... 63 lb per ft
Weight of insulation ..... 5 lb per ft
Total weight per ft ..... 68 lb per ft
Total weight of pipe (93 ft × 68) ..... 6320 lb
Weight of branches, approximately ..... 600 lb
6920 lb

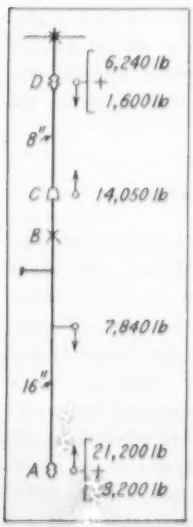
2) Static head at base ..... 324 ft
Pump head at base ..... 100 ft
Total head at base ..... 424 ft, or 183 psig
Area at base: 182.6 sq in.
Force on base due to water pressure:
(183 psig × 182.6 sq in.) 33,400 lb

3)

Bellows Expansion Joint
Static head at expansion joint (324 ft − 93 ft) ..... 231 ft
Pump heated at expansion point 98 ft
Total head ..... 329 ft, or 143 psig
A_1 (Area of expansion joint) 330 sq in.
A_2 (Area of pipe) ..... − 182 sq in.
Difference in area ..... 148 sq in.
$F = PA$ = 143 psig × 148 sq in. ..... = 21,200 lb

4) The resisting force due to stress in the bellows for a copper expansion joint is approximately 200 lb per in. of diameter.
16 in. × 200 lb per in. = 3200 lb
This force is present during the heating season only.

The total force on the base with the pump operating is 6920 lb + 33,400 lb + 21,200 lb + 3200 lb or 64,720 lb acting downward.



To calculate the forces at anchor *B*, isolate the center section.

1) The weight of pipe and branches between joints *A* and *D* is about 7840 lb acting downward.

2) The force due to pressure in expansion joint *D* is calculated the same as before:
Static head at bellows ..... 94 ft
Pump head at bellows ..... 92 ft
Total head ..... 186 ft, or 80 psig
Area of expansion joint ..... 128 sq in.
Area of pipe ..... − 50 sq in.
Difference in area ..... 78 sq in.
$F = PA$ = 80 psig × 78 sq in. = 6240 lb acting downward.

3) Resistance force in bellows is 8 in. × 200 sq in., or 1600 lb acting downward.

4) At point *C* the reduction in area at pipe results in an upward force:
Area of 16 in. pipe ..... 182.6 sq in.
Area of 8 in. pipe ..... − 50.0 sq in.
Difference in area ..... 132.6 sq in.
Static head at point *C* ..... 150 ft
Pump head at point *C* ..... 96 ft
Total head ..... 246 ft, or 106 psig
$F = PA$ = 106 psig × 132.6 sq in. = 14,050 lb acting downward.

Summation for forces at anchor *B*:
Forces acting upward:
21,200 lb + 3200 lb + 14,050 lb = 38,450 lb
Forces acting downward:
7840 lb + 6240 lb + 1600 lb =15,680 lb
Difference in forces 22,770 lb

. . . risers to tower

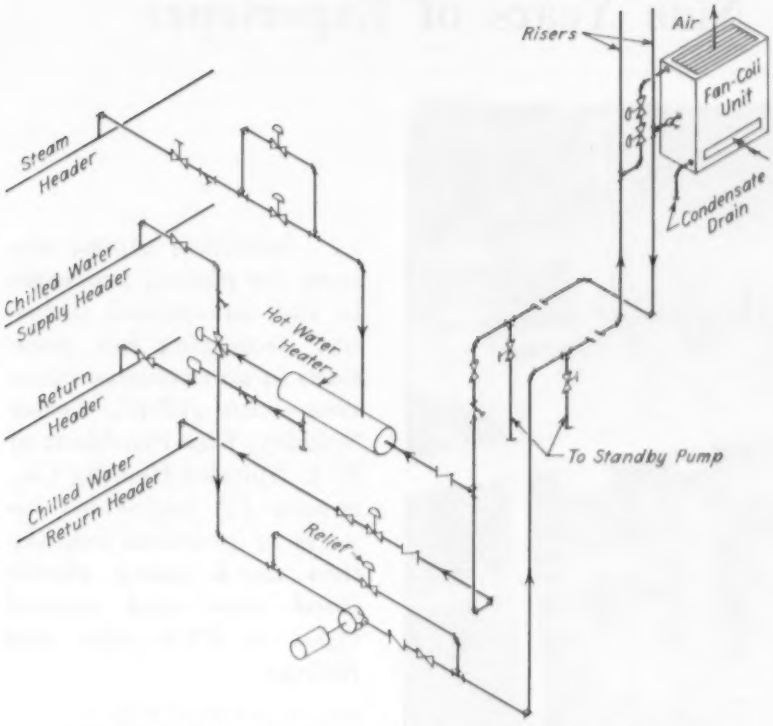
valves are controlled by the leaving thermostat preset at 45 to 50 F which is reset by an outdoor solar compensator for the zone. This prevents overcycling and anticipates changes in load.

During the summer the steam control valves are closed; and when the water valves are modulating, return water enters the three-way valve through the heat exchanger. A relief valve bypass around the pump prevents pressure build-up due to window unit valve closures. During the heating season the three-way and two-way valves are positioned so that secondary water maintains a closed circuit isolated from the primary. At this time the steam control valves operate off the leaving bulb thermostat which is reset at 125 F to supply 100 percent of the heating load for floors 12 through 22. At night, the leaving water thermostat is automatically reset at 180 F and secondary water circulates through the system with pumps on 24 hour service. During this time the window unit fans are not operated since the elevated temperatures of the water induce enough gravity heating and radiation to offset an excessive temperature drop in the building.

Remove Upper Floor Radiators

From the equipment room, five zone supply water mains run in a new hung ceiling on the 11th floor. These mains serve 57 risers at the perimeter of the building. The risers were installed during the heating season at the center mullions of the window bays in order to avoid the old branch piping used for existing radiation. At the end of the heating season, the radiators were removed and fan coil units with copper runout connections were installed beneath the windows. It was possible to salvage all the existing steam supply risers which were then coupled to the window unit condensate drains. All the old heating risers are cut at the 11th floor ceiling. That portion below the 11th floor is capped and remains to

were anchored at 50 ft offset over the Great Hall



4 TYPICAL ZONE SYSTEM — one of five, plus a standby unit, on the 11th floor — includes a booster pump, heat exchanger, three-way and two-way primary water valves, and steam control and water relief valves

heat the lower floor existing radiation. The old steam risers for the upper floors now are drained by a new galvanized condensate drain main, which dumps at convenient locations on the 11th floor.

Reverse return risers starting from the 12th floor, together with the supply water, electric conduit, and temperature control air lines, run up to the 22nd floor hung ceiling. Five zone return mains collect the risers in the ceiling and converge at the main shaft to drop to the 11th floor equipment room. A manifold off the primary water and the five zone returns runs up to an expansion tank in the roof penthouse above.

Offset Tower Risers 50 Ft

A three-cell, induced draft, counterflow, vertical type cooling tower—with pipe spray header and eight blade monel fan—is on the 22nd floor roof. This tower is corrugated cement-asbestos all galvanized steel construction, with an asphalt composition coated, 3/16 in. thick, welded steel pan.

Two 16 in. supply and return lines feed the tower running up the building through a relief air shaft from the sub-basement machine room. It was necessary to offset these risers at the fourth and fifth floors in the building a distance of 50 ft due to the set in the relief shaft over the Great Hall. At the point of offset an anchor was established and the building steel reinforced to take the riser loads.

The building management acted as its own general contractor and awarded a contract to Kerby Saunders, Inc., for the complete installation of the building's air conditioning system. One tenant retained the firm of Krey and Hunt, consulting engineers, to supervise the air conditioning installation in its portion of the building. ⧺

Vitrified Clay Pipe Resists Corrosion, Cuts Maintenance

. . . in chemical plant's acid service lines

CORROSION RESISTANT vitrified clay pipe is solving an expensive maintenance problem and economically handling corrosive processing chemicals and wastes at Harkness & Cowing, Cincinnati, Ohio, according to Dow Chemical Co. and Logan Clay Products Co.

A manufacturer of fatty acids, including stearic and oelic acids, Harkness & Cowing found themselves faced with excessive maintenance and extensive corrosion problems. With the new piping, the dual acid channeling system flows the corrosive sulfuric fluid, used in processing tallow, through the channeling system to a tiled vat, where the tallow is reclaimed, with no evident corrosion. The channel also serves intermittently as a drain system for corrosive chemical wastes.

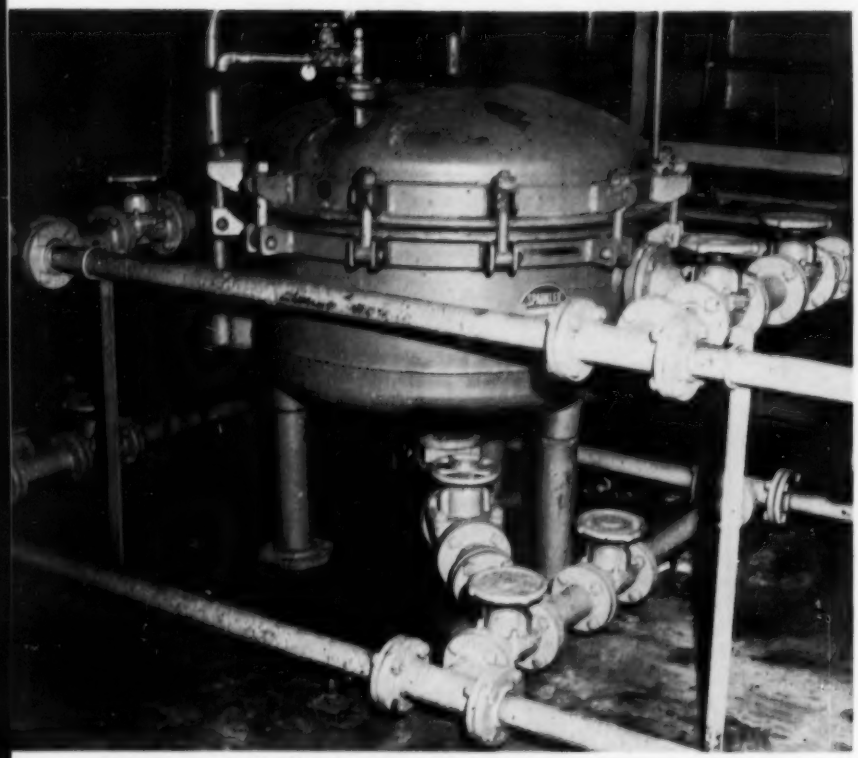
The system, consisting of 33 double sections, is installed in the existing floor, finished with curb tiling and covered with a grille. Drain depth ranges from 10 to 12 in., with an approximate system length of 125 ft.

The system permits rapid, easy hosing of its entirety, allows efficient reclamation tank cleanout at regular intervals, provides a constant runoff system for corrosive spillover and leakage, and permits quick inspection for clogging.

The installation was completed at a total cost of $2200.

The piping contractor was Inter-State Maintenance Co. ⧺

Plastic Pipe: A Leading Contractor Reports on Nine Years of Experience



PLASTIC AND PLASTIC LINED pipe for process liquids — as shown here in this General Motors Corp. plating installation — will be used more extensively, Mr. Spitzley believes, as uniform rating standards are established and as a wider variety of fittings become available

. . . installing piping systems for plating processes in the automotive industry. Answering key questions in an exclusive interview with HPAC, Lester Spitzley, Vice-President of R. L. Spitzley Heating Co., covers 12 important aspects of practical installation work using plastic lined pipe and several types of PVC pipe and fittings.

PLASTIC PIPE INSTALLATION, as far as the Spitzley pipe fitters are concerned, is just another type of pipe; they picked up the techniques quickly. The Spitzley company found that the few problems peculiar to this material could be solved quite easily with a little experience. Recognizing the problems and limitations, and working out procedures to compensate for some of them, seemed to them no more unusual than working with other materials.

For several years this contractor has installed piping systems for plating operations in the automobile plants around the Detroit area. In the early systems they used plastic lined pipe. But during the past year they have used several types of PVC pipe. The pressures involved in these plating operations are low — generally only the head of the tank on the pipe or the pressure imposed by the pumps to circulate the fluids. The temperatures do not exceed 140 F.

A definite advantage in this work, the contractor finds, is the insulating quality of plastic pipe. The plating tanks have high voltage anodes and cathodes which do the job of transferring metal to the product in the plating operation, and with plastic pipe the need for insulating couplings has been eliminated.

However, before plastic pipe can be applied in other areas where the temperatures are above 140 F, Mr. Spitzley feels that its ability to retain its original shape in service after a length of time must be proved.

1. What are some of the problems you have found in the installation of plastic pipe systems, and how do these problems differ from those experienced with metal pipe?

The main problems experienced in the installation of plastic pipe are the joining and supporting of the pipe in the field. Also, the availability of various sizes and the different types of fittings present problems at times.

2. Which of the methods of joining plastic pipe do you use? In your experience, do different applications require different methods of joining?

Joining plastic pipe by threaded joints is the most common method

employed. It is the most satisfactory from the installation point of view. Any pipe dope which is used as a lubricant is used on all joints to prevent binding of the threads when tightening. Without this, the threads bind near the last turn of the pipe and will often cause the pipe to break. There are several types of pipe dopes available, and the various plastic pipe and fitting manufacturers recommend the types to use with their products.

Occasionally a threaded joint is backed by a plastic weld of about two passes if there is any doubt about the ability of the joint to be leakproof. Welding of joints is not used, however, in any of these applications as the sole means of joining the pipe and fittings. When welded, the joints are no weaker than the pipe.

We prefer threaded joints because the same personnel, tools, and methods can be used that are used with metal pipe.

3. To what extent is the pipe prepared for the job in your shop? Are sections prefabricated in your shop, or are pipe threads cut on the site? What problems have been encountered in cutting the pipe and threading it?

Practically all of the pipe is prepared for the installation on the site. There is no advantage in preparing prefabricated sections in the shop, because all of the operations can be more efficiently performed on the site where measurements must be made as the work progresses.

Threads 2 in. and smaller are all cut in the same machine and with ordinary dies. Threads 2½ in. and larger are cut with dies recommended by the plastic pipe manufacturer. These dies cut threads with a different pitch than that used for steel pipe, which has been found desirable for cutting and joining the pipe. With these special dies a hand ratchet is sufficient as the threads are cut very easily. Even on 4 in. and 6 in. pipe no machine is necessary.

4. What problems have you encountered in supporting plastic pipe systems? Have you found it necessary to provide means of support? Also, where plastic pipe is accessible to bumps or knocks, has special protection been required to prevent damage to the pipe and joints?

The main problem in supporting plastic pipe is that it will sag when the temperature is increased beyond 100 F if not supported continuously. In all General Motors installations now, specifications call for the plastic pipe to be supported in this way to insure tight joints and to prevent damage to the pipe. This was specified first at the new Ternstedt Division plant in Flint, Mich., where practically the entire operation is devoted to plating operations for GM products. The plastic pipe is laid in a continuous piece of angle iron, and then the angle iron is supported with hangers as metal pipe is normally supported. With this method, no problems of sagging or leaky joints have been encountered.

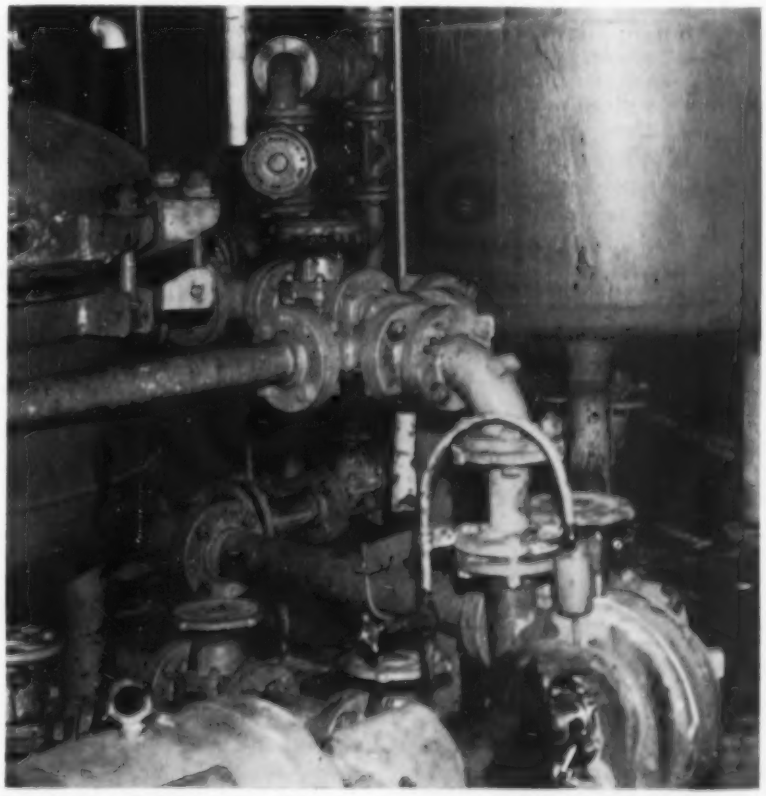
No special precautions have been used or have been found necessary to protect the plastic pipe and fittings from bumps or knocks from workers or mechanical equipment. This has not been a problem.

5. What sizes of plastic pipe have you used in these installations?

The minimum size used is ½ in. for drain lines. Depending upon the size of the plating operation, sizes up to 6 in. have been used for "overflow" pump suctions and other phases of the operation.

6. Why do you think plastic pipe systems are not used more extensively?

The main reason that plastic pipe is not used for more applications is that it is too new and that it has not been proven in a variety of applications. The temperature limitation is one great concern. Plastic pipe should not be used for temperatures above 140 F unless specific recom-



THREADED JOINTS is the method most commonly used by this contractor to join plastic and plastic lined pipe. It is the most satisfactory from the installation point of view, he says. The same personnel, tools, and methods used with metal pipe can be used

mendations are given for temperatures above this range by the manufacturer.

Uniform standards for rating plastic pipe and fittings are needed.

Another problem is the lack of availability of various types of fittings required to make an installation. But this can be expected because of the "newness" of the product.

7. For which of the following applications have you found plastic pipe to be suitable: process liquids, refrigerants, radiant heating, or other?

The only application for which we have used plastic pipe is process liquids. We have not thought of using plastic pipe for anything else because we see no reason for it. The main reason that it is used in the plating operations is because of its resistance to corrosion and expected long life if the temperature, pressure, joining, and supporting limitations are considered.

8. Do you have time study figures for installing various sizes of plastic pipe? For instance, how long does it take to install a given number of feet of 1 in. pipe, 2 in. pipe, and other sizes?

We have no time study figures to answer the question specifically. However, we do not figure any difference in the time for installation as compared with metal pipe. This is, of course, based upon our experience in working in rather congested areas in plants where inaccessibility is more common than may be found in other plant areas or if the pipe were installed out in the open. We feel that the installation of plastic pipe would be faster than metal pipe if sizeable quantities could be used in wide open areas.

9. What problems, if any, have you run into with your pipe fitters installing plastic pipe?

In general, the pipe fitters pick up the techniques very quickly. As far as they are concerned, it is just another type of pipe, and the problems in working with it are not any different or greater than those with copper or other metals. One possible factor is that threaded joints are used exclusively by us, as our pipe fitters are so well acquainted with this method.

10. What provisions do you use for connecting vibrating machinery to plastic pipe, such as pumps, compressors, etc.?

No special provisions have been found necessary in our installations.

11. What is your source of supply of plastic pipe and fittings? Do you keep a stock on hand? How do you decide on the type of plastic pipe and fittings to use?

Plastic pipe and fittings are not stocked by us. The required amounts are obtained from our wholesale jobber who stocks the pipe and orders requirements if not in stock.

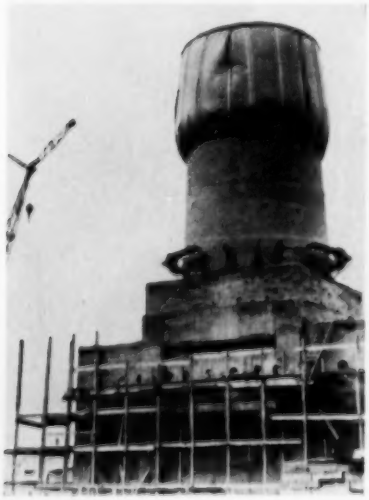
The type of pipe and fittings used depends upon the application and the variety of sizes of fittings manufactured. Generally, the specifications are prepared for these plating operations in such a way that the contractor is permitted to determine the type of pipe and fittings to be used.

12. Do all-plastic valves avoid the problems that might be expected with plastic lined metal valves that are equipped with plastic diaphragms? To what extent are you using the all-plastic valves on these installations.

In the early installations, we used metal body, plastic lined valves with plastic diaphragms. Now that all-plastic valves are becoming available, we have used them on some recent installations. Again, the application dictates to a large degree what is used, especially until the all-plastic valve is proven for the service for which the plastic diaphragm, metal body, plastic lined valve has been successfully used. ⫩

Chimney Wears "Parka" To Speed Construction

. . . in severe winter weather



BAD WEATHER did not stop The Koppers Co. from meeting a tight schedule in building a 90 ft high brick quenching chimney last winter, according to the M. W. Kellogg Co.

Cloaking the chimney, while under construction, with a neoprene coated nylon tarpaulin "parka" not only sheltered workmen and materials but also permitted installation of heating and lighting units. Held against the brickwork and an interior skeletal frame by drawstrings at top and bottom, the "parka" was moved upward as bricklaying progressed 8 to 9 ft at a stretch.

Although there were 26 days with temperatures ranging from 9 F to 30 F, 18 days of rain, sleet, or snow, and one of the area's severest winter storms in history, construction went on, with only one workday lost when winds exceeded 85 mph.

The chimney, 22 ft in diameter at bottom and 17 ft at top, was built for the National Tube Co.'s coke plant. ⫩

Hot Water Floor Panels Increase Precision Grinding Accuracy

. . . cut fuel cost 40 percent and increase production 30 percent in carbide tool plant. Even temperatures 'round the clock enable machines to hold tolerances to 0.00003 in. — and even 0.00005 in. — although only 0.0001 in. is required.

By Carl Niederfringer
President,
The Atrax Co.

RADIANTLY HEATED, small factory — 56 machines and 85 workers — has four zones of three sections each. Each zone has a series of balancing valves and air vents and is controlled by a wall thermostat

THE USE of hot water panel heating where precision machine parts are made has proved a decided advantage to the Atrax Co., of Newington, Conn. Fuel cost has decreased 40 percent per year and production has increased 30 percent.

Because the machines are warm when they are started on cold mornings, it is possible to hold the parts manufactured to the required tolerance of 0.0001 in.

Before the installation of floor panel heating, the machines had to become warmed up before the necessary tolerance could be achieved.

With radiant heat, the machines are always kept at an even 70 F room temperature, both day and night. Any room temperature change to any great extent cannot be tolerated. The panel heating system permits holding tolerances as close as 0.00003 in., and some tolerances of 0.00005 in. are actually ground.

Exhaust 5000 Cfm of Air

The manufacturing area contains 56 machines in approximately 12,000 sq ft. Because grinding operations account for practically 100 percent of the work, a considerable amount of air — 5000 cfm — is exhausted. With so much heat dissipated outside in cold weather, we were worried about maintaining temperatures at constant comfort levels at the time the panel system was installed. But the system has proved satisfactory.

In addition to the precision tolerances obtained, our records show that a minimum amount of absenteeism among the 85 employees has been experienced due to common winter ailments. We attribute this to the absence of drafts and to the heated floor, in contrast to the cold slab with other types of heating systems we have had.

Weather Changes Are Extreme

The terrific New England temperature changes — temperatures have dropped as much as 40 to 50 F within 12 hours — were a problem until the addition of a weather compensating thermostat to forecast such extreme changes.

The boiler capacity is 442,000 Btu per hr. No. 2 oil is the fuel burned. The cost of the entire panel system, including boiler, was $10,500. No supplemental heating is required.

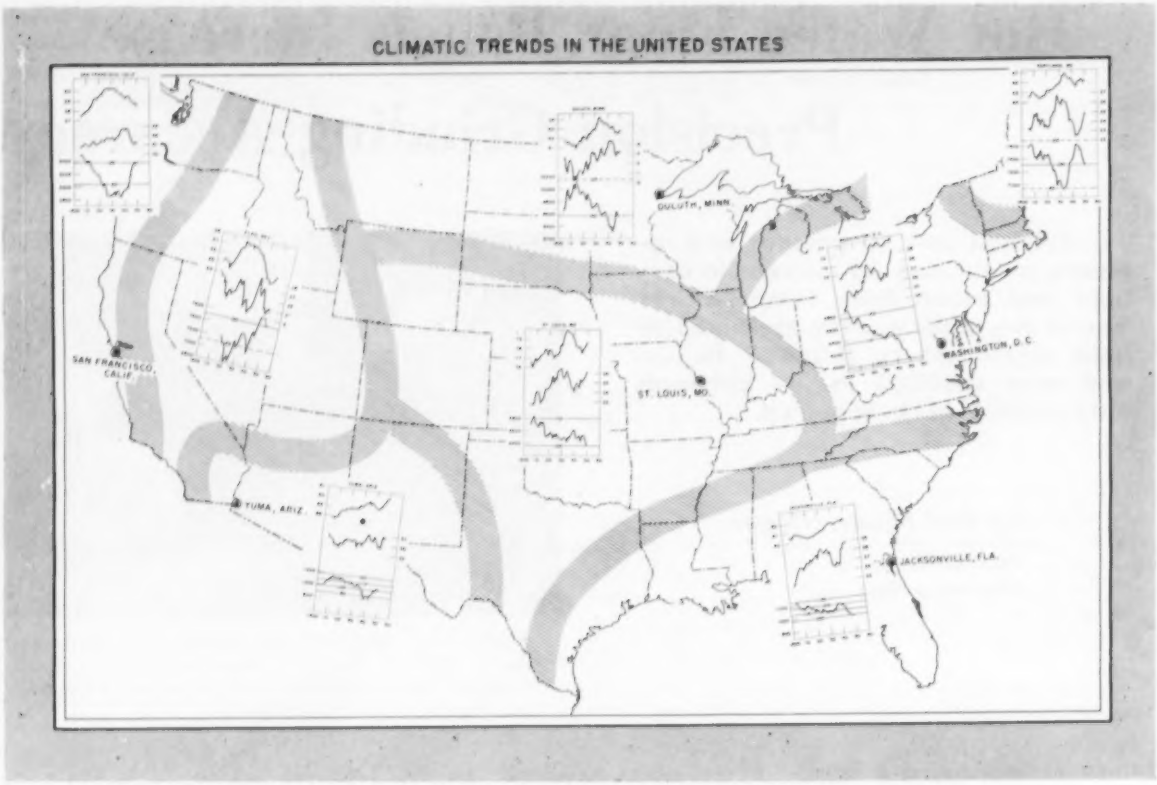
Hot water entering the coils at 120 F and leaving at 110 F is circulated at 12 psi. The entire building is heated with 1 in. diameter steel pipe coils in four zones of three sections each. Pipes are 12 in. on center.

Hot water supply lines are 1½ in. in diameter, and zone supply headers are 1¼ in. Main return headers are 3 in. in diameter, and zone returns are 1½ in. Each zone has a series of balancing valves and air vents in the coils and is controlled by a wall thermostat.

The pipe coils were placed on a vapor barrier, with the supports for the coils raised approximately 2 in. above the ground to assure that the coils were embedded 2 in. in concrete. Individual valves are used to control the flow in the coils.

Insulation around the edge of the floor prevents excessive heat loss through the edges.

The heating system was installed by the Acme Plumbing & Heating Co. The piping was fabricated and installed by Cobra Pipe and Coil Co., Inc.



1 CLIMATE TRENDS at specially selected cities in the U.S. are expressed here as 10 year moving averages centered on the dates indicated. The upper curve for each city represents the June-August mean station temperature. The middle curve represents the winter December-February mean temperature, and the lower curve, the seasonal heating deg day total. Horizontal lines through deg day curve, labeled 100, 105, etc., represent percentages of 1946-1955 decadal average deg day total. Boundary lines represent the very approximate geographical limits within which the major characteristics of the illustrated station trends are believed to be representative of other cities

Link Warmer Climate to City Growth

Here's a new analysis of the U.S. weather picture and its effects on the heating and air conditioning seasons

By J. Murray Mitchell, Jr.
Dynamic Climatology Section
U.S. Weather Bureau

- **weather bureau records show fickle climate trends**
- **moderately cooler climate predicted before 1960**
- **a reverse trend in the 1970's to restore warm climate**

THE MANY hurricanes, calamitous floods, and other memorable weather events which have plagued us in recent years have aroused fresh interest in the idea that our national climate may be drifting into a new pattern. This seems an especially fitting time to take stock of the evidence that climate is indeed a somewhat fickle entity, drawing special attention to those aspects of climatic trends which bear on the heating and air conditioning industry.

1. Is Our Climate Changing?

The dust bowl crisis of the 1930's prompted the first of a series of in-

vestigations into the stability of climate, based upon the Weather Bureau's vast fund of nationwide weather records. In those early studies, ups and downs in climate from one decade to the next showed up, but overall trends in the data were so small that it was difficult to assign practical significance to them.

By the late 1940's, however, so many warm years had become annexed to the record that subsequent trend analyses began to reveal a very significant amelioration of climate since the turn of the 20th century. Overnight, so to speak, our position had evolved from one in which we were just checking to see if any trends were really there, to one in which we seemed to be confronted with an unmistakable shift of climate which now demanded a physical explanation.

This trend toward warmer weather has apparently been common to the great majority of weather stations all over the world, and, significantly, has been corroborated by the wholesale melting of glaciers, a shrinking ice pack in the Arctic, a poleward advance of Sub-Arctic flora and fauna, and other evidence.

Although we have little basis for assuming that this climatic amelioration will continue indefinitely in the future, we are incontrovertibly committed to the conclusion that a warming trend has been taking place *up to the present time*, which has averaged 1 or 2 F since late in the 19th century.

Along with this evidence of a world wide warming, in which much of the U. S. has participated, we must not lose sight of the fact that most historical temperature records throughout the world have been maintained within urban communities rather than in open country. Not only has the population of the world been greatly expanding over the past decades, but an increasing fraction of that population has elected to live and work in the cities and their suburbs.

In the course of time, more and larger buildings have thus come to be built around our thermometer stations; ever increasing numbers of heating plants have been throwing heat into the air around them. Also, thickening palls of smoke and smog—those unenviable trademarks of many of our larger cities—have served to hold in more city warmth at night. Increasingly, the great "deserts" of hot pavement, brick, and stone during the summer have us craving escape to the country or perhaps to the relative comfort of air conditioned areas.

In short, it is clear that the climate of our cities has become more and more unlike the climate of the surrounding countryside, and, what is especially to the point here, that the gradual physical expansion of our cities over the decades has resulted in a similarly gradual trend toward warmer climate as measured at the Weather Bureau Stations in those cities. This gradual increase in local city warmth, which has had no parallel in the open country, may broadly be referred to as "city growth influence."

For the purpose of relating past trends of climate to trends in the general demand for heating and air conditioning equipment and to trends in the contingent demand for fuel and electric power, our city weather records can best be used directly without the need to differentiate very carefully between the city growth influence and general large scale climatic changes which are superimposed on it.

By no means all city weather records, however, are entirely acceptable for such applications. In most cities, the observations of temperature have not been maintained continuously at one location through the years. These changes in location have resulted in inhomogeneities in the climatic record which are difficult to remove statistically, and which otherwise become miscontrued as shifts in the climate itself.

2. What Has Been the Pattern?

Of the approximate total of 200 Weather Bureau city stations in the U.S. whose records extend back to 1900, less than 10 percent are free from the devaluating effects of major changes in station location at one or more times during their history. Records for eight city stations in this limited category are shown in Fig. 1. On the basis of comparison with a larger number of select records, the general form of climatic trends borne out at each of these eight stations is quite representative of that

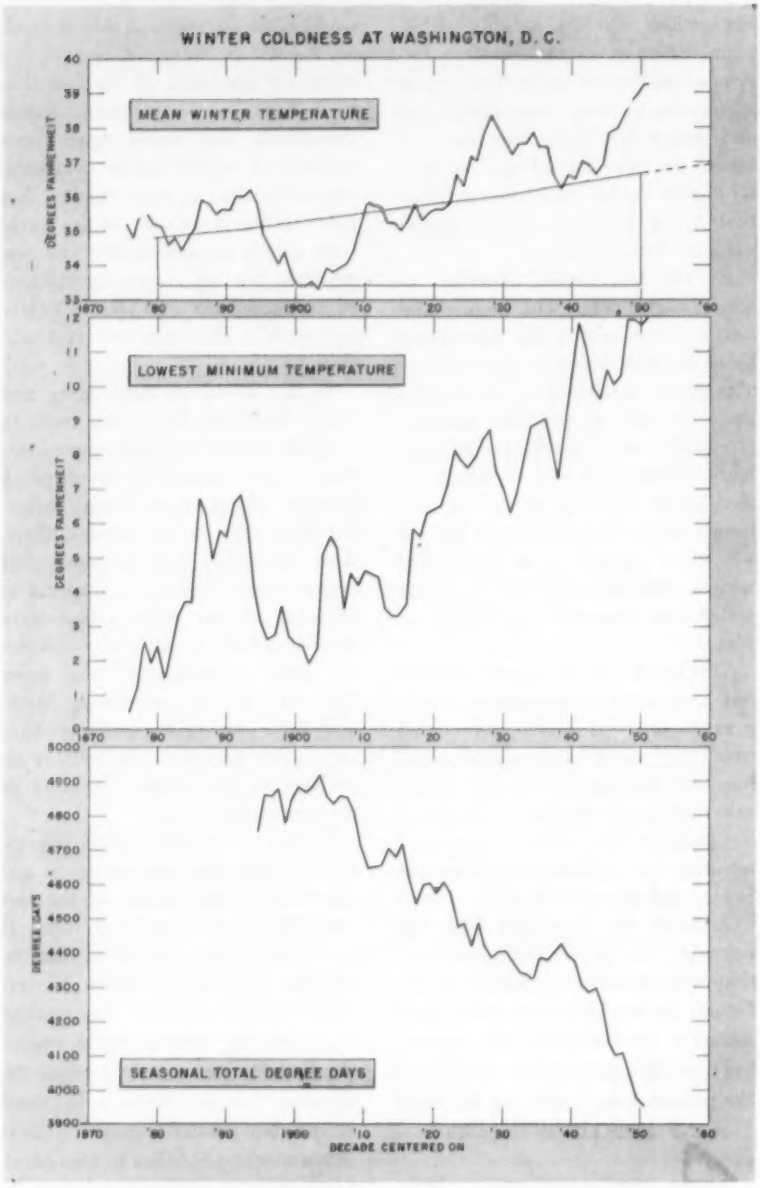
Table 1—SEASONAL DEGREE DAYS — decadal averages — are shown here for selected cities, along with their percentages of the 1946-1955 averages

	1906-1915		1916-1925		1926-1935		1936-1945		1946-1955
Station	Deg day Total	Percent	Deg day Total	Percent	Deg day Total	Percent	Deg day Total	Percent	Deg day Total
Charleston, S. C.	1898	115	1781	108	1720	104	1906	116	1652
Concordia, Kans.	5430	102	5436	102	5246	99	5431	102	5310
Duluth, Minn.	9836	103	9956	104	9712	102	9524	100	9565
Elko, Nev.	....	....	7098	95	7099	95	7322	98	7501
Havre, Mont.	8702	104	8678	104	8127	97	8116	97	8384
Jacksonville, Fla.	1147	118	1071	111	1047	108	1169	121	969
New Orleans, La.	1249	118	1115	106	1178	112	1216	115	1058
New York (Central Park), N. Y.	....	....	....	....	....	....	5115	109	4647
Oklahoma City, Okla.	3778	110	3737	109	3430	100	3561	104	3441
Portland, Maine	7423	101	7456	102	7075	97	7387	101	7314
St. Louis, Mo.	4702	108	4516	104	4458	102	4625	106	4368
Sandusky, Ohio	6175	110	6114	110	5952	106	6011	108	5595
San Francisco, Cal.	3394	101	3178	94	2878	85	2964	89	3363
Seattle, Wash.	5120	112	5219	114	4711	105	4252	93	4582
Washington, D. C.	4646	117	4572	116	4402	111	4376	111	3953
Yuma, Ariz.	1119	113	1118	113	1022	104	884	90	988

applying to most of the cities in the corresponding geographical area which is also designated in the figure. It is well to emphasize that the data is geographically representative *only* with respect to the temporal profile, and approximate magnitude, of climatic variations in the cities. The trends are derived from data between 1900 and 1955 which, in turn, has previously been published in the U.S. Weather Bureau Local Climatological Data. This is expressed as 10 year moving averages in (1) mean temperature for the summer months of June, July, and August, (2) mean temperature for the winter months of December, January, and February, and (3) seasonal deg day totals for the entire heating season.

In nearly every section of the U.S., as Fig. 1 reveals, our cities have shared in a more or less irregular trend toward higher temperatures since the turn of the present century. To varying degrees, each season of the year has participated in this warming. An important exception is to be found in parts of the Rocky Mountain plateau, represented by the Elko record, where the general trend has evidently been toward lower temperatures. It may also be noted that parts of the West Coast, and northeastern New England, have shown very little net change in the 55 year record.

Although the trends at each of these stations surely contain components reflecting city growth influence, a sizeable part of them, together with the irregular fluctuations from decade to decade which are so prominent in some of the records, is due to changes in the frequency of occurrence of fundamental meteorological events, which, in turn, are linked to a continuing, mysterious variation in the wind system over the entire northern hemisphere of the earth.



2 WINTER CLIMATE TRENDS — December through February — are shown here for Washington, D. C. The upper curve represents the mean dry bulb station temperature since the beginning of record. The thin sloping line superimposed on this curve shows the estimated rate at which the temperature in the winter season locally adjusted to expansion of the city. The middle curve represents the lowest seasonal minimum temperature, and the bottom curve the seasonal deg day total. All data is from the U.S. Weather Bureau city station

3. How It Affects Heating

Referring to Fig. 1, let us take a longer look at the trends in winter season temperature—the middle curve in the graph for each city—or, alternatively, the trends in seasonal deg day totals—the bottom curve in each graph. To begin with, we can see that, for the most part, trends in the temperature and deg day data mirror each other rather closely. This is partly because the winter temperatures are low enough to account for the major fraction of the seasonal deg day totals, and partly because the other heating season months have also shared in the long term—"secular"—warming of our climate. It is generally true to say that where winter temperatures have tended to increase, seasonal deg day totals have decreased and have ac-

cumulated over a somewhat shorter heating season, and conversely.

Deg day statistics by decades are given in Table 1 for 16 cities whose weather records are considered to be especially reliable for temporal comparison. The table gives some idea as to how the combined effects of the city growth influence on temperature, and the large scale trends of climate, have influenced fuel demand.

For much of the U.S., it can be said that deg day totals have decreased by 10 percent or more from the beginning of our century up to the present time. The implied fuel saving is, of course, additional to that which is attributable to improvements in heated space insulation, higher operating efficiencies, and other manifestations of technological progress. While it may be rather insignificant in contrast to the prodigiously expanding gross fuel needs of the U.S., it obviously means that an individual home or building owner has benefited by what might be thought of as a hidden discount in his heating bill in recent years.

It is worth interjecting here that temperature may not be the only climatic factor which has significantly affected the fuel demand for heating in recent decades. Fuel requirements are somewhat dependent upon the amount of sunlight which can penetrate the windows of a building to heat the interior by radiation, and are also dependent upon the rate at which the warmed air in a building leaks away.

Although climatic trends in cloudiness over the U.S. have not been thoroughly investigated, it is probable that the entire eastern seaboard of the country has been subject to a significant increase in cloudiness since the beginning of the century. Moreover, while records of surface wind speed in the U.S. have also been little investigated with regard to long term trends, there is some evidence that average speeds have slightly increased since 1900.

The decrease in sunshine implied by the increased cloudiness, and the very slight increase in air leakage through buildings implied by the increased wind speed, are each conducive to somewhat higher fuel consumption. But it is very unlikely that these factors have made important inroads into the fuel savings suggested by the deg day trends.

The mean lowest temperature reached at a station during the winter season has some recognized value for specifying the design of heating equipment. This *mean annual minimum temperature* can, in other words, be used to anticipate the maximum capacity required of the equipment. If one were to consider variations in annual minimum temperature at a particular city from year to year, one would discover a trend in this statistic which approximately follows the trend in mean winter season temperature already discussed but which, in general, has a much larger range of secular variation in terms of degrees Fahrenheit. The greater part of the trend in annual minimum temperature, as in the case of winter mean temperature, can be laid to the city growth influence; the trend would normally be less pronounced in rural environs.

Before we move on to the subject of warm weather air conditioning, let us use the example of the Washington, D. C. city office record to bring out a little further some of the characteristics of climatic change during the winter season that are typical of many eastern U.S. cities.

In Fig. 2 are presented the winter—December through February—mean temperature, the lowest annual minimum temperature, and seasonal deg day totals for Washington, D. C. As in Fig. 1, this data is shown as 10 year moving averages, but in this case they extend back to the beginning of record (1871-72 for temperature and 1889-90 for deg days).

Superimposed on the curve of winter mean temperature is shown, as a thin sloping line, the approximate rate at which temperatures in that season are estimated to have increased due solely to the city growth influence. The distance from this line down to the base line at 33.4 F reflects the estimated excess of temperature at the Washington City Station over the temperature in the open country. The city growth influence trend was derived from a statistical study of the regression relationship between temperature trends, and rates of city growth as characterized by population trends, involving a large number of U.S. cities. Speaking in generalities, the city growth influence at a city station between any two dates can be roughly estimated from the relation

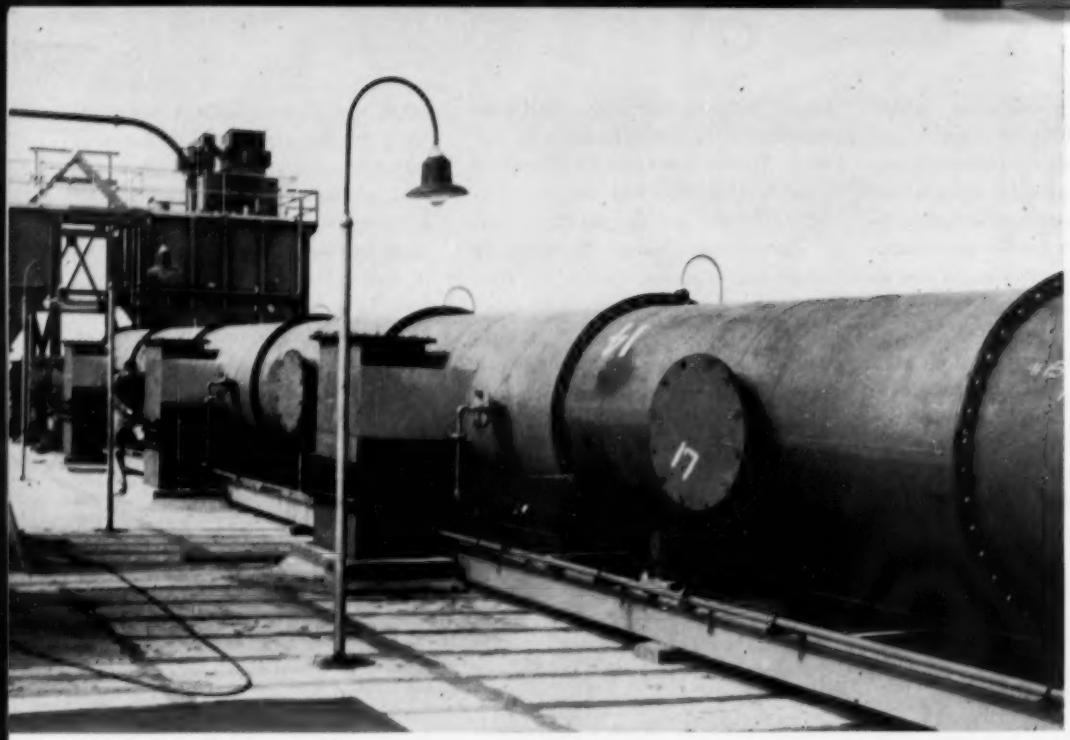
$$\Delta T = K\,\Delta\sqrt{P}$$

where: ΔT = the difference in temperature between the two dates due to city growth in the intervening period; $\Delta\sqrt{P}$ = the corresponding difference between the square roots of the total city population on the two dates; and K = the constant of proportionality which varies in numerical value from region to geographical region and from season to season, but which averages $5 \times 10^{-4} \pm 2(10^{-4})$ for the case of seasonal mean temperatures in the U. S.

Also revealed in Fig. 2 is the strikingly regular trend in the lowest annual minimum temperature at Washington since the beginning of record. In the most recent decades, this temperature has been averaging about 12 F, some 10 F higher than its average back at the turn of our century. Were we to ignore all factors other than climate in specifying the maximum design capacity of heating plants in Washington, we could say that this capacity in recent years need not have exceeded 85 percent of the capacity required 50 or more years ago. It is helpful to emphasize that a large fraction of the trend in annual minimum temperature has been due to the local city growth influence, but that part of it has been common also to rural areas in the same geographical region.

Finally, in Fig. 2, we can see the downward trend in seasonal deg day totals since the beginning of record. This too can in large measure be laid to the city growth influence, which means that the city has increasingly helped to keep itself warm and has played a major part in reducing fuel requirements for heating by 20 percent or so between 1900 and the most recent decades. ⋕

In the next article on our changing climate, the author will discuss how it spurs air conditioning.

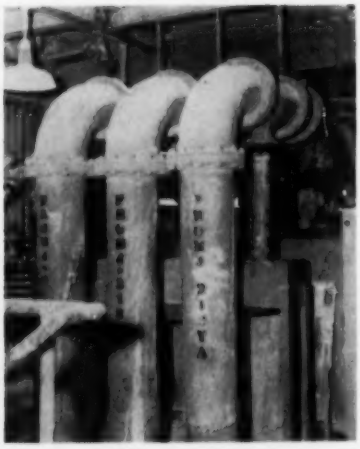


1 RUBBER LINED DUCTS — 54 in. diameter line shown here — convey fumes from reaction tanks inside the plant to four scrubbing towers

Install Rubber, Plastic Linings In New Fertilizer Plant's Piping

. . . to resist abrasion and corrosion

2 FUME EXHAUST DUCTS — two in a series — are connected with ducts from reaction tanks by rubber expansion joints



3 RECIRCULATING PIPE LINES — 10 in. in diameter — are rubber lined. Piping ranges from 4 to 10 in. in diameter, most being 4 and 6 in. in size

By T. H. Mastin, Jr.
LaFavorite Rubber Mfg. Co.

New fertilizer plant which produces, as intermediate products, phosphoric acid and finely divided gypsum depends on protective rubber and plastic linings to withstand "chewing" which results from rapid flow through piping. Generally, rubber is used in the 5000 to 8000 ft of larger piping and in pumps and large process equipment. Plastic, and some rubber, is used in the smaller lines.

More than 80,000 sq ft of rubber linings and much plastic lining are installed in fluid conducting pipe lines and processing and storage facilities at the new triple superphosphate plant of Davison Chemical Co., division of W. R. Grace & Co. at Ridgewood, Fla. Here, in central Florida, about 75 percent of the world's supply of phosphate rock is mined and chemically processed for use as fertilizer. Davison's initial plant capacity of 200,000 tons of triple superphosphate per year represents the treatment of a lot of rock.

4 SPRAY ELIMINATOR in the fume scrubbing area is one of several types of rubber lined large process equipment units

Piping Conveys Slurry

Phosphoric acid gypsum slurry, highly abrasive and corrosive, must be conducted from one point in the plant to another. The acid containing large amounts of finely precipitated gypsum is circulated from one section of the plant to another through piping, and in some cases, through troughs known as "launders" that vary in size from 12 × 12 in. to 30 × 30 in. The rubber linings protect the interiors of these conducting lines from the abrasion and corrosion incident to conveying slurry from one point in the plant to another.

Because of the conditions imposed, the design problem was "double-barrelled": (1) Piping would have to withstand the abrasive action of gypsum particles, however fine, against the "chewing" action which resulted from rapid flow through piping. (2) Piping would have to resist corrosion caused by the acid slurry. A third condition, though important, was not too hard to lick. That was threading pipe lines, with the fewest number of bends, through the maze of equipment, structural supports, and other piping.

It was therefore decided to use rubber lined piping for larger sizes and plastic lining for small sizes, although in some cases the smaller sizes of piping are also rubber lined.

Use 1 Mile of Rubber Lining

Between 5000 and 8000 ft of rubber lined piping — and round ducts up to 54 in. in diameter — are installed throughout the plant. There are also long runs of plastic lined small size pipes. It is difficult to arrive at any exact footage because of the directional changes in the lines.

Installation of the piping, after design layout, was no problem because all lined pipe was prepared in the shops of the fabricator for quick installation. Larger sizes — in fact most—of the lined pipe were flanged for quick connection in the line. Flange connections are also convenient where it is necessary to remove a section of pipe to change a line or add new equipment.

Need Parallel Piping Systems

Two parallel systems of piping are used in some areas inside the plant. This is necessary because of the formation of scale in the pipes. While one system is in use, the other system is being "washed" or flushed.

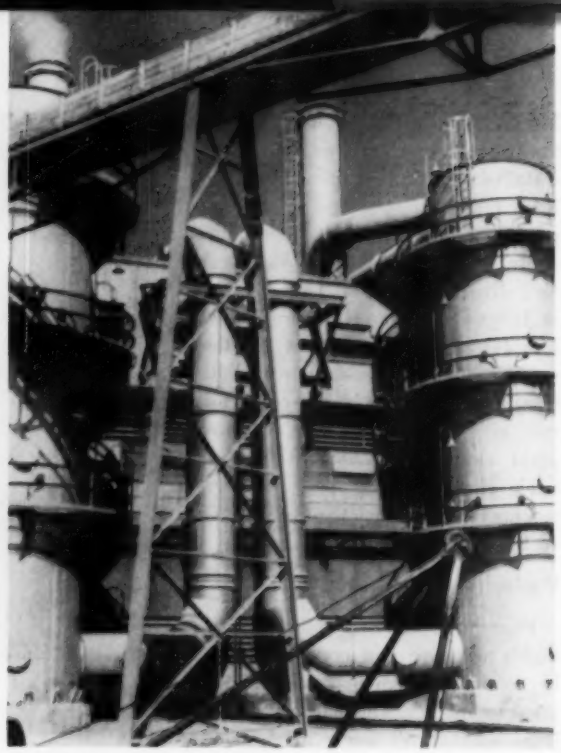
To keep operation and maintenance on a high level, the plant is divided into "areas," each with a maintenance crew and supervisor. Because of the serious results which can follow from any inattention to potential interruptions of production, the maintenance crews must be very alert. Much of the floor areas is expanded metal mesh flooring, so even a small leak on one floor can interfere with production on other levels. Remedial action is instantly taken when little things needing attention are discovered.

Lengthen Pipe Service Life

Most important among the reasons for using rubber lined pipe is the elimination of frequent pipe line replacements. The result, of course, is a substantial saving in expensive materials and high labor costs. As shown by experience in many installations, an indefinite extension of pipe line service life may be expected.

The rubber lining can be applied to all pipe lengths, from close nipples to random 20 ft lengths, and in all diameters from 1½ in. up, and to special bent shapes and other designs. Two 90 deg bends are the maximum number ordinarily recommended per length, although pipe with three 90 deg bends in the same or different planes can now be lined with complete adhesion of lining to metal. This latter feature is especially valuable when design conditions call for complex nesting of pipe lines in confined spaces where close clearances are unavoidable.

5 INSIDE SCRUBBING TOWER, seal of the rubber lining was tested with a 40,000 volt probe, as were linings in large pipes



6 ACID SCRUBBING TOWERS — four in all — two of which are 20 ft in diameter and 60 ft high, extract recoverable byproducts and acid, as well as eliminate air pollution

Piping ranges from 4 to 10 in. in diameter, most of it being of the 4 and 6 in. sizes. Some of the pipe lines and connections are so installed that sections can be disconnected to permit "rodding out" the scale in the pipe. This expediency is used only when necessary. Ordinarily, washing out the system eliminates this deposit in the piping.

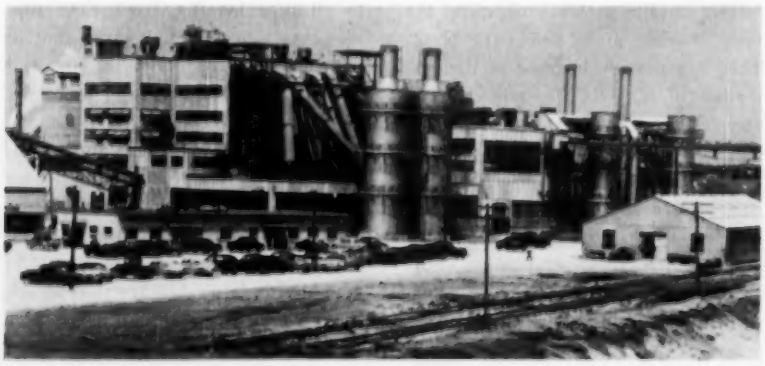
Use Lead, Brick Linings, Too

Fluid conducting lines involved the installation of more than ordinary pipe lines. In some cases, the launders are lead lined, where high acid concentrations are handled. Some launders are lined with lead over which a covering of brick is laid. About 2000 lineal ft of launders are rubber lined.

Huge Ducts Exhaust Fumes

Two large rubber lined ducts — 54 in. in diameter — convey fumes to lower portions of the scrubbing towers from fume hoods equipped with rubber expansion joints. Ducts from the reaction tanks inside the plant connect with the lower sides of the expansion joints. Four round expansion joints and four square expansion joints are installed on each of the large ducts. The square expansion ducts connect with rubber lined ducts extending through the roof from two floors below.

These roof top ducts are but two in a series of such ducts which conduct fumes to the four scrubbing towers for extraction of recoverable byproducts and acid, as well as to eliminate air pollution.



7 TRIPLE SUPERPHOSPHATE PLANT is one of many large scale chemical operations in central Florida

Line Other Large Equipment

Among the larger pieces of equipment which include piping as part of the installation, is a large mist eliminator in the fume scrubbing area.

Other large equipment which was lined with rubber on location includes:

- Four large acid scrubbing towers, two 20 ft in diameter × 60 ft high and two 13 ft in diameter × 55 ft high.
- Six evaporator thickeners — in two series of three each — three

35 ft in diameter × 15 ft high and three 15 ft in diameter × 15 ft high.

- Fifteen agitator tanks, each 15 ft in diameter × 15 ft high.
- Six coolers, each 8 ft in diameter × 5 ft high.

Lining the cone shaped roofs of the storage tanks was a problem because of the segmented construction. However, the segmented construction also proved to be helpful. All edges where segments joined the body were sealed, and a final test over the entire interior was made, using a 40,000 volt test probe.

Steam Cure Rubber Lining

Insulating jackets were made for the large scrubbing towers. Steam, injected inside the towers to cure the rubber lining, was obtained from an old railroad steam engine on a siding because the steam plant was not in operation at the time this work was done. After being lined, the towers were subjected to a thorough test of the lining with a 40,000 volt probe.

The plant was designed and engineered by the consulting engineering department of Dorr-Oliver, Inc. and built by Consolidated Engineering Co. The piping contractor was the Contracting Division of LaFavorite Rubber Manufacturing Co. ⧺

ON THE JOB

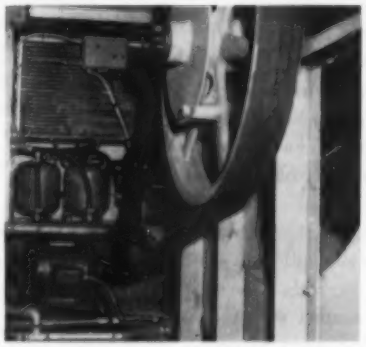
Versatile 60 Ton Packaged System Conditions Theater

. . . eight 7½ hp units operate in four pairs

FLEXIBILITY of the newly installed air conditioning system almost steals the show at the 1200 seat Roosevelt theater, Jacksonville, Fla., as far as the manager is concerned, according to the United States Air Conditioning Corp.

The 60 ton system uses the lower halves only — containing compressor, condenser, controls, cooling coil, and filter — of eight 7½ hp packaged air conditioners and a single large blower.

The system provides four-step control of cooling capacity, as the units operate in four pairs of 15 hp each. For partial occupancy or mild weather, only one pair operates. As the theater fills up or the outside temperature rises, additional capacity is automatically provided as required.



FOUR STEP CAPACITY is automatically provided as needed. Single large blower, right, delivers conditioned air from four pairs of packaged conditioners to a single main supply duct

In case of the temporary failure of one unit, 52½ tons of cooling capacity are still available.

The units are installed in an equipment room which serves as a return air plenum. Conditioned air is delivered by the single blower from the units to the theater in a single main supply duct having three circular ceiling diffusers. ⧺

Activated Carbon Filters Help Cut Production Loss

. . . bar sulfide gas from photo plant

BY INSTALLING activated carbon air filters and by maintaining a slight positive air pressure in a critical plant area, the Metalphoto Corp., Cleveland, Ohio, drastically lowered manufacturing costs, according to the Connor Engineering Corp.

Sulfide gases which formerly seeped into the plant from the surrounding semi-industrial neighborhood occasionally caused fogging of photo sensitized aluminum plate made by the photo company. These gaseous contaminants, although so dilute that they cannot be detected by the sense of smell, caused severe damage to the plates.

According to R. A. Kempe, vice president of the company, the filter system cost less than half the loss resulting from one batch of damaged plates.

Since the filters were installed a year ago, there has been no recurrence of the trouble. Air movement now is outward instead of inward, and all ventilation air is admitted through the filters. ⧺

Tiny Fish Block Intake, Stop Air Conditioning

. . . at Chicago Tribune

WHEN THE 1700 ton air conditioning system of the Chicago Tribune was turned on recently, nothing happened.

Tremendous quantities of river water are used in the Tribune's two main systems. In the steam jet system, water is employed to condense the spent steam. In the centrifugal system, it is used to absorb heat produced in the refrigerant condensers and is then returned to the river through an 18 in. main.

Maintenance personnel checked the two huge intake pipes which draw water from the Chicago river for the system and found the openings plugged with smelt. The heavy ½ in. wire screen protecting the 16 in. opening through which water is siphoned into the system from 14 ft below the river's surface was plastered with thousands of the tiny fish. The fish prevented water pumps from maintaining their prime and the cooling system couldn't operate.

The situation improved the following day as the smelt run eased up and building maintenance crews succeeded in operating the system at one-quarter speed. ⧺

Question of the Month

What Caused Joints to Fail in Copper Tube Heating Main?

THE QUESTION, *What Caused Joints to Fail in Copper Tube Heating Main?*, was asked previously in HPAC and is repeated here along with answers that have been received. Other answers for publication will also be welcome.

"I am interested in getting some factual information about the possibility of trouble arising from the installation of Type L hard copper tube as a heating main with copper fittings in the hot water heating system in a basementless structure built on a concrete slab. The tubing is installed below the concrete slab in the 2 ft of gravel fill under the slab.

"The 1 in. hard tubing is about 3 in. below the bottom side of the slab. A layer of felt paper was applied over the gravel prior to the pouring of the 4 in. slab. Therefore, no concrete was permitted to be in contact with the copper tube. All runouts from the heating main to the sections of cast iron baseboard are Type L flexible tubing, also covered with heavy asphalt covered felt paper to prevent the concrete from contacting the tubing. All soldered joints were cleaned thoroughly with sand paper, steel wool, flux, and then 50-50 solder was applied. The temperature of the water in the heating system varies between 160 F and a maximum of 210 F.

"After the system had been installed three years, a leak developed in the main. In removing a section of the concrete floor, we found that the tubing at one end of the joints had broken the soldered connection and was pulled out of the fitting about 3/8 in. It seemed that there was not as much solder as there should have been at the soldered joints, and in some places, the solder was so thin at the joint that the tubing could be seen.

"I would like to have answers to the following questions and any comments that HPAC readers would like to make about similar experiences that they have encountered. I would like to have as many facts as possible.

"1. Is it possible that galvanic action or some other electrolysis action is taking place between the gravel, the copper tube, the hot water, and the solder which would tend to weaken the joint and remove the solder?

"2. Is it possible that the temperature of the hot water is too high and that this is causing the joint to lose its strength over a period of time?

"It is my theory that with the heating main installed in loose gravel and not in contact with the concrete, it would be able to expand and contract without causing any great amount of pressure on the soldered joints. In the expansion of the tubing, the tubing would be pushed farther into the fitting, so the leak was undoubtedly caused when contraction took place as the tubing cooled.

"We have done many jobs of this type and have used various combinations of flexible tubing with flared fittings, and up to this time we have experienced no trouble except on this installation."—R. P. W.

Some Copper Tube Joints Fail Because Of Improper Design of the System

WE ARE GLAD to share with R.P.W. something of what experience has shown us to be the mechanism of failure of joints in copper tube heating mains.

There are two conditions in which copper tube is properly protected with reference to expansion and contraction. One is when the tube is completely embedded in a single slab of dense concrete, plaster, or other material, and the tube and the embedding material expand and contract together as one. The other safe condition requires the provision of sufficient flexibility to prevent excessive strains from developing. This flexibility may be provided by the configuration of the piping itself, or by expansion joints and similar devices. Connections, hangers, and anything which touches the piping must be designed in such a way that loss of flexibility does not occur if tube strain is to be avoided.

Sand or gravel or a mixture of the two may appear to be loose and yielding, but this is really a surface condition and not a condition that occurs below the surface. Even the loosest material becomes unyielding after it has been loaded with a few tons of building construction and allowed to settle for a few months. If the tube is installed in such material, it will not be able to expand and contract freely.

The force developed during expansion amounts to about 15,000 psi of copper cross sectional area for a 100 F rise. This is usually sufficient to cause the tube to slide through the surrounding material until part of the

READER ASKS—

"How to Filter Salt Out of Air?"

"We are interested in obtaining information as to how to filter salt air in an institution near the seashore. The salty atmosphere has a marked corrosive effect on all of the equipment with which it comes in contact, as we all know, and I would like to know how to handle this problem.

"I have considered the use of air filters, and I have considered the possibility of condensing the salty moisture out of the air as it passes through air conditioning apparatus. In each case, I have met doubt as to the soundness of the method.

"Any help or experiences that others may be able to cite will be greatly appreciated." —R. E. Z.

• *YOU ARE INVITED to contribute a question for publication or an answer to a published question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

stress is relieved. If the tube is butted against the stop of the solder joint fitting, probably no harm will be done to the joint during expansion. When the line is cooled, it contracts and the stress is reversed. The reversal of stress placed a tensile load on the solder joint which may exceed the long term strength of the joint. The joint may fail by a creep of the solder in the joint, in which case failure will occur not during the first contraction but gradually over many contractions.

After the joint has failed, the tube may continue to slide back and forth in the fitting, as the tube contracts and expands.

At the same time, the flow of water through the joint may erode the solder or the tube, or both. By the time the leak has become detectable, the appearance of the solder joint may be altered considerably by the fretting action and the erosion. The solder may appear to have "rotted away," corrosion may be suspected, or the loss of solder may be blamed on poor workmanship.

It is extremely unlikely that galvanic action or other electrolytic action is taking place between the gravel, the copper tube, the hot water, or the solder in the failure described. Solder has less strength at high temperatures, but the proportions of solder joints are such that adequate strength will be obtained with conventional solders in the temperature range stated, even though the joint may not be absolutely perfect.

In a given system, the weakest joints will of course fail first, but it should be remembered that they do not necessarily fail because of their weakness. The situation is often such that some joints must fail because of the improper design of the system. The proper corrective measure in such a case is to eliminate the basic cause of the failures and not to simply strengthen the joints.

Slab-on-grade construction, including garden apartments with several buildings served from a single heating plant, account for a major increase in the amount of copper tubing being installed by burying. At the same time, there has been a proportionately greater increase in the number of failures in such tubing, particularly in lines carrying hot water. Most of these failures could have been avoided if the installations had been made properly.

Strain from expansion and contraction is probably the greatest source of trouble, and it is one of the least well understood phenomena. In exposed lines, most installers recognize the need for providing for expansion and contraction and install offsets and "three elbow" connections almost automatically, but many fail to recognize that it is just as necessary to provide for expansion and contraction in buried zones.

All lines will be exposed to some changes of temperature, and buried lines should be assumed to have a variation from minimum soil temperature to maximum fluid temperature, or the maximum temperature produced by adjacent piping or other heat sources. No dependence can be placed on the constancy of temperatures because of continuous operation or similar factors. Thus a hot water line buried in soil which reaches 35 F in winter should be assumed to have a variation of 180 F to 35 F, or 145 F, if the maximum temperature is 180 F.

Some idea of the forces which can be produced by expansion and contraction can be seen by calculating the thrust for a temperature change of 100 F for a few sizes of copper water tube:

Type and size of copper tube	Thrust produced by contraction and expansion, psi
½ in. L	1093
¾ in. L	1729
¾ in. K	2438
1 in. L	2497
2 in. L	6678
4 in. L	20,537
6 in. L	38,858

This thrust will be developed whenever the tube is completely restrained from expanding. The actual thrust — or pull, in the case of contraction — will be in direct proportion to the degree of restraint. For example: if a 2 in. type L tube is 100 ft long, it will expand 1.18 in. for a 100 F rise if it is completely free to do so, and no thrust or strain will result. If it can move only 0.5 in., it is restrained $(1.18-0.5)/1.18$, or 57.6 percent, and the thrust produced will be 57.6 percent of 6678, or 3846 psi. This load must be carried by the fittings in addition to the load caused by the hydrostatic pressure. The total load on 2 in. 50-50 solder joints should not exceed 1077 psi, so such a line can be

expected to fail at the joints unless the situation is corrected.

There is no question that the best engineering practice when designing piping systems is to provide little or no restraint to expansion and contraction, so that practically no force other than that caused by the hydrostatic pressure will occur at the joints.

A soft solder joint made with 50-50 solder is adequate for piping so designed but, because experience has shown that few buried lines will be completely unrestrained, hard or silver joints are recommended for this service. The use of stronger solders will not eliminate the need for careful design for minimum restraint, because forces sufficient to break the tube itself can be developed in a poorly designed system.

Soft tube from coils is the best material for underground service because the usual irregular alignment makes it less affected by expansion-contraction and ground shifting. Liberal amounts of tube should be installed to provide flexibility, and no attempt should be made to keep the line very straight. Flared joints are generally recommended for this service.

The best way to install hard tube underground is to provide a tunnel, support the tube in air, and design for exposed piping. However, the cost of a tunnel usually prevents its use except where many different lines must run between buildings and must be accessible for maintenance.

The next best way to install hard tube underground is to follow these principles:

1) Buried section should consist of a single straight line. Each line should consist only of straight tube and couplings. Wrought couplings are preferred because of the small outside diameter regardless of the solder used. If silver solder is used, wrought couplings are desirable for ease in making the joints.

2) Lines should be free to move axially. Surrounding material offers little resistance to the motion of the tube or coupling.

3) Ends of the buried lines should be free to move to accommodate the axial expansion without developing excessive strain in either the buried line or the connected exposed piping.

In the installation of long lines, special provisions should be made because of the magnitude of the expansion, possibility of ground settlement, and the weight of the long line, but the principles still apply.—R. L. Maher, Engineer, Tube Products, Chase Brass & Copper Co., Inc.

Fitting May Have Been Over-Sized, Thus Preventing Proper Capillary Action

I do not believe that there was any galvanic or electrolytic action occurring in this installation. Also, I do not believe that the temperature of the water was too high for the solder or for the conditions of the installation.

Accepting the fact that the joints were properly made, two theories might be advanced to account for this failure. The first is that the fitting was sufficiently oversized so that proper capillary action did not take place; solder got into the joint and was spread over the surfaces but did not fill the joint to provide proper cohesion between the surfaces.

The other theory is one that I have been considering for many years because I believe it could be possible, yet there is no way to prove it. If the line is in sand, when the main expands and the branches are pushed through the sand, sand trickles into the place the branches formerly occupied. When the tube cools, this sand prevents the tube from returning to its original position so that it is under tension. When the cycles are repeated, this tensile effect may become cumulative until rupture takes place. Both of these conditions are remote, as shown by the fact that this contractor has experienced only this one complaint in over three years.

The best recommendation that I can give to a contractor who feels he is doing a conscientious and thorough job is to discard a fitting if it is too loose on the tube. I think if this is done, no trouble will be experienced.—Arthur I. Heim, Research Engineer, Copper & Brass Research Association. ⧺

Contraction Is Main Cause of Failure; So We Prefer 95-5 Solder for Joints

As to the causes of joint failure in copper tube heating mains, R. P. W.'s specific questions may be answered briefly as follows:

Question No. 1—There would have to be some unusual condition existing to cause electrolytic failure. We do not believe this to be a contributing factor.

Question No. 2—The water is not too hot for a properly designed and installed heating system.

I believe that contraction is the main cause of failure. Of course, many factors enter into construction of a heating system. Disregarding poor workmanship, the layout has to take into consideration expansion, contraction, and the type of solder or brazing alloy. Naturally, costs are an influencing factor. If the stresses of expansion and contraction are relieved by an expansion loop or joint, 50-50 solder should prove satisfactory.

As noted in the U.S. Dept. of Commerce Building Materials and Structure Report BMS 58, at 200 F the sheer strength of 95-5 solder is about five times that of 50-50 solder. Therefore, if soft solder is to be used, it is advisable to consider the 95-5 solder as a safety factor. Of course, brazed, flared, or compression joints would provide a stronger joint.

Because of frequent failures with paste solder, its use is losing favor. On two projects of similar construction, with the same welder, 50-50 solder in one proved satisfactory; paste solder in the second proved costly due to repairing failed joints.

We have seen 50-50 solder used in a large housing project with no failures occurring in three-story buildings, but numerous failures occurred in a similar setup

when the building was 14 stories high. In this case, expansion loops and 95-5 solder solved the problem.

One question often asked is, can you partially embed risers in concrete? The answer is, avoid it if possible, or provide for expansion and contraction. Otherwise, the result may be fatigue failures in the risers, joints pulling apart, or a combination of the two.

Expansion and contraction must be considered at all times, as failures may occur from fatigue even if the joint was strong enough to withstand the forces generated.—R. A. BEATTY, Supervising Engineer, Quality Control Div., Reading Tube Corp.

Evidence Indicates Poorly Made Joints Responsible; Penetration Lacking

FROM the description given, the evidence would indicate one or more poorly made joints. We have never seen, nor have we ever heard of, a soldered joint from which the solder properly filling the joint when first made had been removed over a period of time through galvanic or any other action. Even if electrolytic action could occur in such a situation—for which there is no evidence on record—it should be remembered that it can take place only with the presence of moisture. If the joint was properly made and tight in the first place, I do not understand how the moisture could penetrate throughout the area of the socket in order to permit galvanic action to proceed. The obvious conclusion is that if bare metal was seen after the joint came apart, proper penetration of the joint did not occur at the time it was made.

The second question raised concerned the amount of reduction in strength of a soft soldered joint under service conditions involving elevated temperatures. Long-time tests made at the U. S. Bureau of Standards on the strength of soft soldered joints in copper tubing have indicated that such joints are satisfactory for normal service conditions in hot water heating systems at operating temperatures up to 250 F. Table 4 of the Bureau of Standards Report, U. S. Dept. of Commerce Building and Materials Structure Report BMS 58, shows that the allowable pressure ratings for joints made with 50-50 tin-lead solder decrease with an increase of temperature. But even at 200 F, the allowable service pressure of 100 psi for nominal sizes 2 in. and smaller is several times the normal operating pressure of a hot water system. As the report states on page 20, "Allowance should be provided for imperfectly soldered joints and for stresses imposed on the joints from sources other than the internal pressure in the tubing. Subcommittee No. 11 of the American Standards Association decided that an ample margin of safety would be provided by the ratings in Table 4.

Since this is the only installation of this kind with which the contractor has had trouble, this would appear further to put the burden of proof on the quality of soldering on this job rather than on the suitability of well made soldered joints for such installations.—NEWELL W. SMITH, Heating Engineer, Research Dept. Revere Copper and Brass, Inc.

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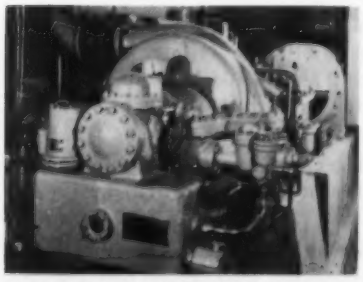
260 Ton System Conditions Richmond Art Museum

. . . by central refrigeration plant and two packaged units

REMODELING and expansion of the Virginia Museum of Fine Arts, Richmond, recently included installation of a 260 ton air conditioning system that cools the entire structure, according to the Worthington Corp.

The museum is divided into three levels: the top floor gallery, the services level, and the ground floor activities level. Offices, classrooms, studios, an art library and library stacks comprise the services level. The activities level has a luxurious lounge and refreshment room for museum members, storage space, shipping and receiving rooms, workshops, and a 500 seat theater.

A central refrigeration plant in the subbasement and two packaged units provide 260 tons of cooling. A centrifugal compressor, condenser, water cooler, and pumps, part of the central refrigeration plant, circulate chilled water to each coil of the system. Water cooling towers are on the roof over the workshops. The system provides automatic temperature and humidity control. ≠



REFRIGERATION PLANT in subbasement, with centrifugal compressor, condenser, water cooler, and pumps, supplies chilled water to all coils

MUSEUM has three levels: Top floor gallery, shown; offices, classrooms, studios, libraries; lounge, storage, and work rooms

New Sheet Metal Techniques Applied for AEC Project

. . . for ventilating the atom

By W. C. Locke
Project Engineer
George Koch Sons, Inc.
Ventilating Contractor

POWER CAULKING 235 miles of ⅛ in. wide and 1 in. deep joints between insulation panels was done by adapting air operated grease pumps. Steady delivery of the sticky, black compound at pressures to 4000 psi assured penetration to the lock-joint base of the 2 in. thick glass fiber and sheet metal panels. Device overcame difficulties of hand trowelling and hand caulking gun methods

New techniques of fabrication, storage, assembly, and erection of 4 million sq ft of insulation panels, 14 million lb of ventilation ducts, and 500 large fans were required for economical installation at the Atomic Energy Commission gaseous diffusion separation plant near Portsmouth, Ohio.

THE ATOMIC ENERGY COMMISSION gaseous diffusion separation plant near Portsmouth, Ohio, is one of the largest industrial plants in the world. In the separation of Uranium 235 from U 238, uranium hexafluoride, heated to the gaseous state, undergoes molecular separation through the use of porous barrier sheets. The gases must be maintained at temperatures far above the operating tolerances for motors and operating personnel. For this reason, a very large amount of insulation is installed around process equipment, and enormous volumes of air are used for cooling operating areas.

Twelve hundred miles of process piping, discussed in the article, *Piping the Atom*, in the July 1955 HPAC, and several thousand compressor-converter units — installed in a total area of 210 acres in three major process buildings — required the installation of 4 million sq ft of insulated panels. In the form of glass fiber sandwiches between sheet metal faces, most panels measure 24 × 50 × 2 in. They are removable for access in servicing the process equipment. Erection economy required many new methods.

The ventilation systems also required new installation techniques. This mammoth installation required 500 large fans having either floor or ceiling mounts. The fans bring in over 24 million cfm of outdoor air, circulating it through 14 million lb of ductwork.

PRE-ASSEMBLED FLANGED DUCT SECTIONS up to 30 ft long were moved to buildings on flatbed wagon trains after being loaded by hoist trucks. Later assembly on the floor enabled whole branches up to 60 ft long to be raised an average of 17 ft for installation

• Panels insulate process gas piping bundles and equipment cells

The insulating panels are of two major types: those used for enclosing bundles of process gas piping, and those erected like a two-story cottage around each of several hundred cells, or groups, of process equipment.

The process gas piping enclosures, which extend duct-like for approximately two miles, required panels to be dispatched to the second floors in related groupings. One lift by overhead cranes moved the panels from trucks in delivery alleys on the first floor to the point of installation on overhead framework on the second floor. Rolling scaffolds of unique telescoping design were used for the installation of sides and bottom; the top was merely laid in place. The telescopic scaffolds adjusted easily for varying heights above floor level.

The hundreds of cell enclosures — called "cottages" — were grouped on the ground floor of the process buildings several days prior to scheduled erection. A material dispatcher coordinated delivery of the cells so that they arrived on the busy erection floor to coincide with the receipt of erection drawings and the arrival of erection engineers.

Caulking of all joints between panels was necessary to maintain the high operating temperatures of process equipment. The caulking compound was a very heavy, viscous, rubber base material. It was to be injected into 235 miles of joints having a cross section $\frac{1}{8}$ in. wide by approximately 1 in. deep. The required full penetration to the lock-joint base of the joints was unobtainable with hand trowelling methods as the sticky, black compound was unmanageable. Hand caulking guns were tried, but their limited capacity resulted in an excessive amount of reloading time.

Finally, one of the engineers recalled a successful application of air operated grease pumps for cold spraying very heavy grease to protect marine bull gears during the war. He proposed the trial of similar equipment for the troublesome caulking compound. Heavy duty pumps, previously used on the project for a mobile greasing and maintenance unit for earth moving equipment, were tried out with success. The units proved capable of a steady delivery of caulking compound at pressures up to 4000 psi, assuring full penetration to the base of the joints. No material handling was involved, since the pumps could be set on the tops of the original containers and clamped in place. With the use of a specially designed flat, narrow chisel tip, judicious travel along the joint resulted in full penetration without excess material to require re-work.

• Pre-assemble branch ducts, hoist to duct stand for installation

The ventilating ductwork, amounting to 14 million lb, was divided into supply and exhaust systems. Total rated delivery is 24 million cfm, for the supply systems. The buildings are maintained under a positive hydrostatic head of 0.1 in. water gage to exclude both external duct and process gases from the operator's areas.

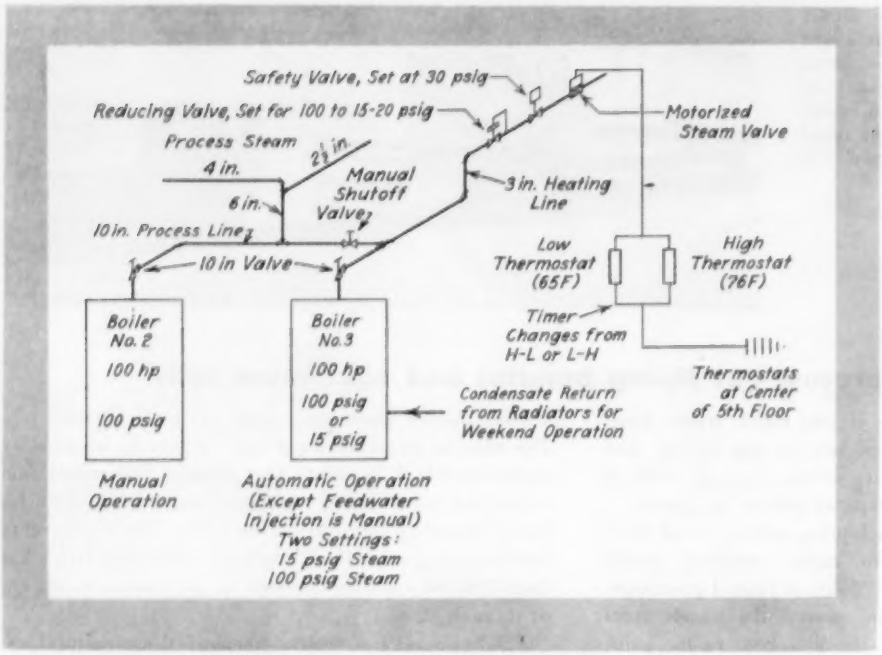
Duct in sizes up to 218 × 60 in. was fabricated offsite. Several acres were needed for yard storage. Material control of material fabricated in many sections of the country was simplified by storage in related groupings. Check lists assured completeness of each shipment.

The branch ducts were pre-assembled of flanged sections in the yard, in groupings up to 30 ft long and weighing up to 1200 lb. The pre-assembled branches were then moved by hoist trucks onto "trains" of rubber tired flatbed wagons. After movement into the buildings — during the evening shift to minimize interruption of erection — assembly on the floor enabled whole branches up to 60 ft long to be raised an average of 17 ft for installation. Larger sections of duct were hoisted from the wagons to the top of "duct stands," built of appropriate height to place the duct in line for connecting the flanges with the duct already in place.

The large — 87,000 cfm — supply fans were designed for simple floor mounts. With fork trucks used for millwrighting, installation of the fans was straightforward.

The bulky exhaust fans were designed for ceiling mounts. As rigging by chainfall was both hazardous and expensive, supervisors developed this into a power installation by building a set of adapters to fit the forks of a gasoline powered hoist truck.

Installation of ventilation system and insulation was performed on a cost plus fixed fee basis. The general contractor was Peter Kiewit Sons' Co. ⁂



HEADER JOINED BOILERS operate together to furnish steam to a 6 in. process line and to a 3 in. heating line. On weekends, Boiler No. 3 operates alone at 15 psig for heating

Changes Steam Piping: Saves Fuel

. . . in drug manufacturing plant

Installation of a common header between two boilers — one producing 100 psig steam and the other 100 or 15 psig steam — has reduced fuel consumption 30,000 gal per year for process and heating. Timer actuated high and low thermostats control steam flow via a motorized steam valve.

By E. C. Beeler
Plant Engineer
Wyeth Laboratories, Inc.

—as told to HPAC

WHEN the three 100 hp steam boilers were installed in the Twelfth Street Laboratory building of Wyeth Laboratories in Philadelphia, three needs were present. The capacity was governed then by the electrical load for the plant that had to be generated from steam produced in these boilers. Secondly, process steam at pressures varying between 100 psig and 15 psig was needed. Thirdly, steam was required for heating the laboratories and offices. The boilers and connected piping were arranged so that one of the boilers supplied steam for heating at 15 psig; and the other two, for electrical power generation and for process at 100 psig.

In the early '30's the need for producing electrical power was eliminated when the Philadelphia Electric Co. started to supply the required power. In 1952 Boiler No. 1 was then taken out of service, and

the remaining two boilers were converted to burning No. 6 Bunker C fuel oil. Either boiler could carry the total remaining load.

Fuel Consumption Too High

Under this arrangement of operating Boilers No. 2 and No. 3 individually for process needs and heating, the ratio of steam used for these two steam services was 70 percent for process steam and 30 percent for heating. The annual fuel oil consumption for the 1951-52 heating season operating under this arrangement was 160,000 gal. It was felt that the fuel consumption was too high and that an improvement could be made in the piping systems connected to the two operating boilers.

This assumption was based upon three reasons:

a) Considerable waste heat in operating a 100 hp boiler under capacity at a pressure of 15 psig, could not be recovered.

b) The human element required to set the thermostat to lower temperatures at night and on weekends was not dependable and therefore was an additional waste of heating steam.

c) Since only one boiler was required, the operation of two boilers for separate needs was consuming more fuel than necessary, and thus this was a waste.

Change Piping, Add Controls

The piping was changed so that Boilers No. 2 and No. 3 were connected by means of a common header 10 in. in diameter. This pipe size is too large for present needs, but since the pipe was already connected to each boiler, it was used. It had been sized previously when the maximum load on the boilers was determined by the steam required for power generation.

A 6 in. line takes process steam off the header into branches 4 in. and 2½ in. in diameter for two areas of the plant. A 3 in. line is connected to this header for supplying steam for heating through a steam pressure reducing valve set for a differential of 100 to 15-20 psig.

After the steam pressure is reduced, the control of steam flow is achieved by means of a motorized steam valve which is operated by two thermostats in parallel. One thermostat is set at 65 F, and a timer switches this thermostat into the circuit in the evenings and on weekends. Likewise, this timer switches the thermostat set at 76 F into the circuit in the mornings when the plant is to be occupied again.

Either boiler can be used for heating so long as a fireman is present. Over weekends, heating is accomplished by operating Boiler No. 3 only. At this time, the operating pressure is set for 15 psig.

The heating steam is delivered to radiators in all five stories of the building, including the laboratories and offices. No attempt has been made to zone this system, as the location of the high and low thermostats was studied very carefully, and it was decided to install the thermostats in the center of the fifth story. This location has proven to be closer to ideal than was hoped for before the operation with this control could be actually tried.

Fuel Consumption Reduced

The volume of the heated space is made up of five stories of plant and offices 185 ft × 90 ft × 13 ft high. During the two heating seasons after this changeover, the annual fuel consumption has been reduced to 130,000 gal of No. 6 Bunker C fuel oil.

The ratio of process steam used to that used for heating is now 79 percent for process and 21 percent for heating. This may be compared directly with the ratio of 70 percent for process and 30 percent for heating before these changes were made. There has been no change in the requirements for process steam between the 1952-53 and the the 1955-56 heating seasons. Therefore, the only change was in the heating, and this resulted in an appreciable saving of about 30,000 gal of fuel oil annually.

This change in piping and control of the heating steam for the plant was accomplished on two Saturdays without interruption of the production schedule. ⊣

FIVE-STORY STRUCTURE now uses 79 percent of its steam for process and only 21 percent for heating, instead of the previous ratio of 70-30

Photo courtesy Iron Fireman Mfg. Co. and Petro.

Discuss Air Pollution Control

. . . at air pollution session of 18th annual American Power Conference. Regulatory and research responsibilities — both of current leading interest — were the subjects of two papers, which are condensed here.

• abatement movement seen as inevitable

By Frederick S. Mallette
Executive Secretary
Committee on Air Pollution Controls
The American Society of Mechanical Engineers

Increasing air pollution and demands for relief are shaping control developments that can only mean more restrictive laws and, finally, capital expenditures for abatement equipment for industry and business in general.

THE ATMOSPHERIC SEWER is backing up and, like a swarming bacterial colony, we are beginning to suffer from the accumulation of our own wastes. Today the overall problem of air pollution is demonstrably worse. Causes of this increase in pollution are: the tremendous growth of population in our cities; the enormous increase in numbers of automobiles, trucks, and buses; the incineration of vast amounts of rubbish; the combustion, both domestic and industrial, of terrific volumes of fuels; and the great expansion of manufacturing processes of all kinds, many resulting in new and, as yet, uncontrolled effluents.

To alleviate this problem of modern civilization, we are trying, at the moment, to legislate air pollution out of existence. The solution to the problem is not quite so simple. Since the decrees of Elizabeth I, legislative efforts have been numerous but largely ineffective. London smog in 1952 took over 4000 lives. In the U.S., the Donora smog of 1948, though less serious, was nevertheless a disaster.

The public demands relief, yet, ironically, the public itself is responsible for much of the pollution. Exhausts from millions of automobiles, stinking clouds from millions of backyard incinerators, and incomplete combustion of much fuel have all been shown serious contributors to air pollution.

Industry is by no means guiltless, but in facing up to the air pollution problem, in effort and support for research, and in money spent for the study and for the control of its own effluents, industry has, in general, done far more proportionately than the public. There lies ahead for industry even more to do. And perhaps the public too may have to tackle its individually insignificant, but collectively enormous, problems.

For industry and business enterprises in general, increasing air pollution control activity means restrictive legislation and ultimate capital expenditures for abatement equipment. Except in the case of a major war, this movement is inevitable; it is just a question of time. For some communities, it is here; for others, it is just around the corner; for still others, it may be several years away.

The control of air pollution is not going to be cheap — in fact, it is going to be tremendously expensive. As with every other cost added to a project, the consumer finally foots the bill. The public will ultimately pay for all air pollution control but, meanwhile, does not realize it.

Carefully planned educational programs are helping all concerned to move toward solutions of the great economic, social, and technological problems posed by air pollution and its control.

• whose responsibility is research?

By W. L. Faith

Vice President and Chief Engineer
Air Pollution Foundation

Responsibility for air pollution research can well be divided in four main ways for a more effective comprehensive approach: local government, federal and state governments, industry, and the community.

WHEN WE START a research program, we assume we have a problem that can be solved by an orderly scientific investigation. We first direct our study toward determination of the basic nature of the problem, and follow this by a study of means of alleviating it. We further assume that basic facts will lead to the engineering applications necessary to solve the problem.

Air pollution research is no exception. We know we have problems — problems of health, well-being, and economics, and in some cases, even of existence. In this case, I mean the existence of the commercial enterprise responsible for the pollution problem.

Classify Emissions

By and large, the greatest quantities of contaminants that reach our atmosphere are the result of heat and power production, either through incomplete combustion or through the use of imperfect fuels. Faulty combustion releases tons of unburned or partially burned fuel into the air every day. These emissions may be classified as:

1) Gaseous emissions: carbon monoxide; low molecular weight hydrocarbons, alcohols, aldehydes, and acids; oxides of nitrogen; and sulfur dioxide.

2) Finely divided solids: particles of carbon, and fly ash.

3) Liquid particles, or aerosols: usually organic compounds of high molecular weight.

As man and industry have congregated in limited areas, the natural ventilating action of the air has been overtaxed, and excessive concentration of contaminants have created an air pollution problem. In addition, as man has gained more leisure, he has become more critical of the state of the air around him. We won't willingly destroy our cities, so we are faced with the problem of purifying our stack emissions and engine exhausts, or of upgrading our fuels, or both.

As scientists, engineers, and intelligent beings, we must admit we don't know how to do these things adequately or we would have done them. Few Americans today are so stupid or selfcentered that they believe air pollution is inevitable and that we have to learn to live with it. To solve the problem intelligently, we must first get the facts — we must conduct research.

Four Research Requirements

The four requirements for a successful research program are:

1) A real interest in solving the problem.

2) Personnel of suitable caliber to initiate and carry out the program.

3) Money.

4) Perseverance.

Since these four requirements are not unreasonable, we come to a key question: "Where does the responsibility lie to initiate and finance the necessary research?"

There are two sources of research funds — public and private — which may be used in several ways.

Private money is almost entirely "industry" money. These funds may come from the company producing the pollution, the equipment manufacturer, the fuel supplier, or a public spirited company having no motive other than civic welfare.

Public funds, on the other hand, arise solely from tax money. Generally, these are divided into federal, state, and local funds.

Keeping these sources of research money in mind, let us look at the responsibilities and competence of three different segments of our society in terms of the research job to be done: government, industry, and the community.

Air pollution research may be subdivided into four categories:

1) Chemical, physical, and meteorological aspects of atmospheric reactions.

2) Health aspects of air pollution, including damage of vegetation.

3) Identification and measurement of emissions at the source.

4) Development of abatement methods.

Divide the Responsibility

• Local government should be responsible for:

1) Determination of the rate and type of emissions of air pollutants from local sources.

2) Monitoring the atmosphere for important contaminants.

Generally, local government has come into the picture through its responsibility for protecting the health of the community and guarding it against nuisances. The authority to do so may be vested in a health department or a statutory air pollution control agency.

• Federal and state governments should have joint responsibilities for:

1) Determining the relationship between air pollution and public health.

2) Determining the maximum allowable concentrations of air pollutant under various atmospheric conditions.

3) Determining the nature of air pollution problems that transcend local, state, or national boundaries or affect general agricultural pursuits.

The function of the federal government in air pollution research has been vested primarily in the U. S. Public Health Service. Here, interest is principally in the health aspects of air pollution and, secondarily, in educational activities. Also, work at the federal level can include emergency aid to local communities.

The role of state government, through its health department, is similar. Certain basic research studies are, of course, carried out in state universities and colleges as a part of their normal educational programs.

Obviously, however, industry must set its own house in order. This requires factual knowledge of the character of stack and equipment emissions under all conditions; it may require a knowledge of the fluctuation of atmospheric contaminants for miles around; and it may require the development of corrective equipment or new operating practices.

The necessary research could be done by a single company or by an industrial group. In most cases, no direct commercial return results from air pollution research, so joint action is feasible. Several groups of this type conduct or support research and sponsor voluntary control programs.

In most of the cases, the prime interest of the sponsor is to assess the air pollution problem of a given environment. Development of abatement methods has usually been left to individual companies because of the patent aspects. However, the automotive industry, through the Automobile Manufacturers Association, is making a joint effort both to assess the problem and to develop exhaust control devices.

• The community — business, industry, government, and the public — through an appropriate device, should provide for:

1) Coordination of air pollution research activities so that no phase of the problem will be overlooked.

2) Objective, impartial studies where necessary to assess the nature of the local problem and means of alleviating it.

3) A centralized source of public information to allay the emotional outbursts that so often result from misinformation and hinder orderly procedures.

As a general rule, industrial installations are more efficient than nonindustrial, so more than half of the pollution reaching the atmosphere usually comes from nonindustrial sources. The entire community is responsible for the condition of our atmosphere, but large segments of the community shrug off their responsibilities for alleviation of the problem.

Los Angeles has solved this problem of coordinating community action on air pollution in a unique way. A group of civic minded citizens organized the private, nonprofit, independent Air Pollution Foundation in 1953. The foundation has only one goal: elimination of smog. It receives contributions from industry — both so-called pollutors and non-pollutors —, banks, hotels, insurance companies, race tracks, and from many other segments of the community, including private citizens. Through the medium of specific contracts from the Air Pollution Control District, public funds have also been made available.

This money is then used to supplement district efforts and to sponsor needed research on air pollution in existing capable research organizations, under the direction of the scientific staff of the foundation. Reports of progress can be made directly to the public by an organization representing all segments of the community. We believe this unified approach of a community to its air pollution problem is equitable and will be successful. ⧺

Study Indoor Climate For Air Academy

. . . in experimental rooms

A UNIQUE EXPERIMENT to find an ideal "indoor climate" in which cadets of the Air Force Academy—to be built at Colorado Springs, Colo. —will learn most effectively has been undertaken by engineers of the Air Force Academy Construction Agency and Minneapolis Honeywell Regulator Co.

Two 13 by 18 ft dormitory rooms have been built in duplicate of the quarters which will house the Academy's 2600 cadets. These rooms will be the first structures to be built on the 17,500 acre site.

The rooms are equipped with sensitive research instruments which read and record air temperatures at six points, chart the effects of the sun, air movement, humidity, and other conditions that affect human comfort and efficiency.

Automatic temperature controls which permit indoor conditions to be regulated also record the effects of the changes. The effects of the intense weather conditions must be taken into consideration as the climate in that area has intense daytime sunlight, cold nights, rapid outside temperature variations, and climatic changes.

It is essential that conditions in the dormitory rooms be coordinated and designed to provide the most efficient "learning climate" as much of the cadet's actual learning will come from after-class study, according to Col. Albert E. Stoltz, director of the Air Force Academy Construction Agency.

Instruments used in the unique experiment include a two-sphere radiometer, which measures and records the effect of sunlight on inside temperatures, shows what happens indoors when the sun goes down or is obscured by clouds, and measures the gain or loss of radiant heat due to sunlight, bright skies, or cold walls and windows. ⧺

The Law and Your Profits

By William Hurd Hillyer

Will Oral Agreement Hold in Court?

WHEN a heating, piping, and air conditioning contractor makes a proposal which is orally assented to by the general contractor, to what extent can the former rely upon this acceptance?

The Sandville board of education advertised for construction bids on two school buildings, according to the architect's plans and specifications. The general contracting firm of Municip Structures urged Faire D. Gree, as subcontractor, to submit a bid on the heating, piping, and air conditioning. This he did verbally at a meeting with Municip in a Sandville hotel. His figure was $57,000, based upon relevant specification items. Gree made a note of the bid in his pocket memo book and, while talking to Municip, copied the figures on a slip of paper which he handed to the general contractor.

Shortly thereafter Municip Structures, having received a bid of $56,900 from a different subcontractor, got in touch with Gree and told him his bid was being undercut. Gree thereupon reduced his bid to $56,700. Later the same day, bids were opened by the school board and Municip Structures turned out to be the lowest bidder. Gree asked Municip on the spot, "How do I stand?"

"I'll Give You a Subcontract"

"All right," he said before witnesses. "We used your bid; we listed you on the bid we turned in, and when I get a contract I'll give you a subcontract."

Gree mailed Municip a confirmation bid the same day. After a week's lapse, the latter came to Gree's office and told him that objections to him as subcontractor had been raised by the board's architect. Next day, Municip dropped in again to inform Gree that he had a still lower figure of $1900 less from still another heating, piping, and air conditioning contractor. To Municip's request that he lower his bid still further, Gree said he could absorb about $500 of the sum, but he considered such methods of bid shopping unethical.

Having talked with one of his suppliers, Gree wrote Municip that he was unable to lower his bid. After reminding the general contractor of what had transpired in the office of the school board, he quoted that body's president and architect as assuring him his work was "very satisfactory" and that no preference would be given against him. Municip wrote in reply that it was contrary to his firm's policy to "bid shop" but that he would place the subcontract where he pleased. This he proceeded to do by giving the work to one of Gree's competitors.

Faire D. Gree thereupon sued Municip Structures for breach of contract. He contended that a contract came into being upon Municip's oral acceptance of his subcontract immediately after the opening of the general contract bids by the school board. In defense, Municip claimed that it was not the intention of parties to enter into a binding contract; that the bid was made informally; that no conditions of the work were discussed other than the fact that Gree's bid covered divisions 20 and 21 of plans and specifications. Municip further contended that his "casual remark" after the bid opening could not have amounted to a formal acceptance of Gree's proposal; that what the parties contemplated was "execution of a written subcontract." The general contractor tried to use the subcontractor's good faith and ethical outlook as weapons against him, citing the fact that Gree had approached suppliers in an effort to reduce his bid and had written to Municip urging him to fulfill a "moral" obligation.

In spite of these defenses and claims, subcontractor Gree won a judgment of $6700 in court. General contractor Municip then appealed.

Agreed on Essential Terms

The state supreme court conceded that the parties had not agreed on such matters as a bond of the subcontractor, reciprocal liability for delay, nor time provisions for remedy of defects. Nevertheless, the justices announced, "we do not believe the contract is defeated because there is no specific agreement in these matters," but are of the opinion that "the essential terms had been agreed upon: the materials and labor to be furnished were specified in the plans and specifications;" cost was settled upon; time of performance was governed by contract between the general contractor and the school board. The trial court's judgment, ruled the higher tribunal, "does no damage to the well settled rule that a contract to enter into a future contract will not be enforced unless the essential and material terms have been agreed upon." Therefore, the lower court's judgment, in favor of subcontractor Faire D. Gree, was affirmed. ⊣

WILLIAM HURD HILLYER, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., he has an extensive practical legal background.

This series presents actual cases. Naturally, laws vary in different states. All names are fictitious.

LETTER FROM LONDON

By Lester S. Ries

Formerly Superintendent
Buildings and Grounds
Oberlin College

'Invisible' Hot Water Panels Heat New Bank of England Building

Many new buildings of great size are going up in the bombed areas. Hot water heating systems use both coil and perimeter ceiling panels but few floor panels. In the new bank — a typical new building — ventilation air is supplied to offices through outlets above transoms and is exhausted through door cracks into corridor "plenums."

IN A PREVIOUS LETTER [*Electric Space Heating Encouraged in Britain,* in the July HPAC] I described some aspects of electrical energy space heating that I found in use in the British Isles. Space heating by means of "invisible" panels using forced hot water circulation is being designed for many of the buildings being erected at the present time. The rubble of the bombed areas has largely been cleared and sites prepared for new construction. Numbers of skeleton buildings are still standing, whose interiors have been gutted by fire bombs, but these are slowly being demolished. New buildings, many of great size, are going up in the bombed areas, and thousands of Council houses are springing up all over England. This new construction is giving the heating engineers and contractors a wonderful opportunity, to which — in most cases — they are responding quite satisfactorily.

Since retiring from active administration at Oberlin, the author has been a consultant to the college. Thus, he is not "on leave" from Oberlin as was incorrectly stated in the July HPAC. At present he is visiting Great Britain to study several college and university heating systems and to observe postwar government and private heating progress there.

New Bank Is Six Stories High

A good typical example of contemporary installations is the new Bank of England building going up on Cheapside, practically under the shadow of St. Paul's cathedral in the heart of London. The firm of Young, Austen & Young, Ltd. is the heating contractor. Their managing director, W. L. Swain, who is a member of the American Society of Heating and Air-Conditioning Engineers, was my host.

Heat for the 8.5 million cu ft building is furnished by oil fired hot water boilers. Water is heated to 200 F and pumped through four calorifiers — heat exchangers — with a 30 F drop. Each of the four calorifiers serves a section of the six story and two basement building. Hot water from the calorifier is circulated throughout the building, and its temperature is thermostatically controlled through a mixing valve with a maximum of 128 F when the outside temperature is 30 F or below. A drop of 20 F is calculated for the return to the calorifier. The design temperature is 65 F when outside temperature is 30 F. W. J. Stevens, the design engineer, was on hand during the visit to the building. He explained that average temperatures below 30 F were so unusual that they were not considered in any system design for London.

Use Ceiling Panels Throughout

Ceiling panels are used throughout the building. In the office and smaller room areas a central corridor with suspended ceiling conceals the tempered supply and extraction — exhaust — air ducts. Supply air enters each office through an outlet above the fan light door — transom — at 60 to 65 F, preferably 1 or 2 F under the room temperature. "Extract" air is drawn out of the corridors, reliance being placed on looseness of doors to extract two-thirds of the volume of supply. No recirculation is provided. Eight fan rooms serve

the building. Each supply fan has a copper tube blast coil, an air washer, and dry filters.

In all but the large, formal banking quarters on the ground floor — first floor — and in rooms where acoustic tile is needed, space heating is done by means of ceiling panels. These panels are generally at the windows and consist of ½ in. steel pipe coils with the pipe on 6 in. centers. The coils are fabricated in the shops, tested to 350 psi hydraulically before delivery to the site. There they are laid in their designed locations on the bottom of the concrete floor slab form — here a form is known as the shuttering — and surrounded with "slip tile." Slip tiles are ordinary 10×4×3 in. high partition tiles split into three units, so that one such tile makes three pieces 10×4×1 in. These splits are laid to completely surround the piping, the spaces between the legs of the pipe coil and the pipe connection to the supply riser. The floor is poured and great care exercised to insure the concrete embedding the coil and slip tile. The slip tile furnishes the key to hold the white plaster cast, which is applied to the ceiling with a thickness of 1 to 1¼ in.

The floor slab in this building is 9 in. thick. In the areas where acoustic tile applied to the ceiling is required, a 1 ft border is left bare around the perimeter and the ½ in. piping is laid in this area in the same manner described for the coil slip tile and all. The perimeter piping is hydraulically tested on site before the floor is poured.

Fabricate Some Coils on Job

The large high ceiling banking areas require individual coil fabrication on the job. The ceilings are an architectural feature designed with a pattern of rectangular recesses of varying dimensions. The ceiling coils are fabricated to fit each of these many recesses but are similarly treated after installation, even to the 350 psi testing.

Great care is exercised in starting the heating cycle in order that the plaster will not crack or check. Instruction sheets given the engineer of the new building advise that "flow temperature must be reduced to 80 F when recently plastered panels are put into operation. It is held there for not less than seven days and then gradually raised to 100 F during the second week and to 120 and 128 F at the end of the third week."

Panel Association Successful

Young, Austen & Young is one of the 14 heating contractors supporting the Invisible Panel Warming Association, of which H. H. Bruce is the technical director. This private organization carries on continuous investigation and research for the member firms and is responsible in large measure for the great number of successful panel heating jobs in England. I know of no similar organization in the U.S., and the fact that it is successful here may stimulate enough interest there to investigate further its functions. ⫩

Dual Zone System Heats, Cools New Building Year 'Round

. . . first major structure in downtown Salt Lake City for 30 years

ULTRA-MODERN 12 story building features individually controlled units under windows, plus interior zone air handling units

FEATURING a year 'round, dual zone air conditioning system, the $3 million, 12 story First Security building in Salt Lake City is one of the Far West's newest and most attractive buildings and the first major construction job completed in the downtown section of Utah's capitol city during the last 30 years, according to the Spang-Chalfant division of The National Supply Co.

The perimeter zone, with under window units, is individually controlled by thermostats. The units are supplied hot or chilled water through steel piping and high velocity air through ducts from the building's penthouse. In the penthouse, the return and outdoor makeup air is washed and tempered. At the window unit, a regulated flow of air is supplied through a noise eliminating device and heated or cooled to the desired temperature.

The interior zone is supplied conditioned air by ductwork from the mechanical room on each floor, where each system is a separate unit.

The refrigeration plant is in the basement. ⫩

PIPING for steam lines, chilled water lines, and condenser water lines ranges from 2 to 8 in. in diameter

Sam Lewis' Page

"Too Low a Flue Gas Temperature Can Lead to Troubles"

. . . such as corrosion of boiler surfaces and chimney lining supports and blacking out of photoelectric safety controls

ENGINEERING seems to be a matter of compromises in many situations, as is life itself, of course. For example, in a boiler plant, a low flue gas temperature is desirable for reasons of fuel economy. But, on the other hand, if the temperature is so low that moisture condenses from the flue gases, we may encounter corrosion problems.

Moisture Corrodes Surfaces

Sometimes a metal chimney which is exposed to the outside air is cooled by the winds to such an extent that moisture in the gases condenses on the chimney interior. This may cause the supports for the chimney lining to corrode away. As a consequence, the lining will fall down inside the chimney.

This problem is most apt to come up with a boiler of a design that tends to surround the gases of combustion with relatively large heat absorbing surfaces, and to interpose so many baffles against the passage of the flue gases that their emerging temperature is so low as to demand fan induced draft. From the fuel economy viewpoint, that's fine; but the other problem shouldn't be overlooked.

I am led to think that we must look with care to analysis of the chemical characteristics of fuel oil — and of gas, too — even as we learned, long ago, to purchase coal on the basis of a guaranteed analysis.

Following the development of methods for the highly efficient burning of residual fuel oil — as a case in point — we found a situation which demands attention. When the oil has a high sulfur content, the sulfur does not always vaporize to the extent that it will be expelled to the outer air at the chimney top. In an economical boiler, the corrosive constituents of the fuel oil tend to condense on the coolest heat absorbing areas of the boiler. There they combine with moisture to attack or destroy the boiler surfaces. Several highly efficient oil burning boilers I have known seem to have thought they were sulfur extractors!

Use Steam-Hot Water Converter

I have noted evidence that a hot boiler — by which I mean one that has a steam output temperature of over 300 F — burning oil with a high sulfur content will make for longer boiler life than one with a steam or hot water output temperature of 212 F or less.

On many jobs, I have been inclined to the use of hot water for heating because of the high heat transmission rate and the low flue gas temperature. In the light of the chemical peculiarities of fuel, perhaps I should think of burning it in a really hot steam boiler, and then of heating the water — if it is more desirable to circulate water — by means of a converter.

Soot Blacks Out Safety Device

The problem is not confined to jobs burning oil. For instance, a big industrial boiler recently became temperamental. When I was asked for advice, my instant reaction — via telephone — on the cause of the trouble was improper adjustment of the air-oil ratio, which could have blacked out the photoelectric safety control. When I suggested this, the answer was snapped back to me: "We are burning natural gas."

Gas has, of course, been employed for years in the manufacture of lampblack, I reflected. It is well, when considering combustion problems, to remember that gas fuel — as well as other fuels — has complex and sometimes objectionable chemical "fellow travelers." ≠

SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems.

How to Apply, Maintain Valves

A BAD VALVE is one that will not properly open, close, throttle, check, bypass, or relieve. A leaky, deformed, or defective valve not only wastes fluids, but is hazardous as well. Because of the risks, including system breakdowns or fatal accidents, maintenance of valves should be planned carefully and scheduled properly.

Nine out of 10 valve failures are caused by abuse. Among the most obvious abuses are:

1) Spinning the valve wheel, and other improper methods of opening and closing valves.

2) Abrupt shutoff of small globe valves in bypass assemblies.

3) Failure to equalize inlet and outlet pressures before opening or closing large valves.

4) Failure to blow off accumulated condensate in steam or compressed air piping before opening the main valve.

5) Failure to keep solids out of fluid.

Wrong use or misapplication of valves can make efficient valve operation unattainable even under the best of maintenance conditions. Wrong pressure, or improper temperature characteristics, incorrect valve types, and unsuitable materials for the service are errors commonly made in valve selection.

Manufacturing defects account for about 10 percent of valve troubles. Occasional leaks due to a blow hole in a body casting, a bad seat, a loose valve stem, or a defective thread are to be expected. These manufacturing defects may appear a year or more after valve installation; so fault detection in materials is a continuing task.

Abstracted from the U.S. Navy's Bureau of Yards and Docks Technical Digest No. 54.

Inspect Valves Regularly

Inspection periods for valves will depend largely on the frequency of operation and on the type of system. A lubricated plug valve in an underground gas piping system may require attention only once in five years, while in a steam plant a main steam valve may require daily operational maintenance inspection. Quarterly, monthly, or weekly inspections are in order for valves in other systems. Each activity should determine its own inspection schedule, and it should be based on the value of the fluid, volume of flow, and other operating conditions.

Inspections should include an examination for valve leaks and corrosion, a check of valve shutoff, trial of pressure relief valves, and a test for hissing noises, chatter, or water hammer of valves.

Better maintenance can prevent leaky valves and save wasted dollars.

Repair of valves consists mainly of cleaning, adjustment, and replacement of worn parts or complete units. A brief summary of valve problems is given below.

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1. (a) What is the difference between valves and plug cocks? (b) What are the most common uses of plug cocks?

(a) The opening and closing operations of gate or globe valves depend on the rise and fall of gates or disks respectively, but most cocks depend solely on clockwise or counter clockwise rotation of vertical cylinders or tapered plugs to achieve opening and closure. Another advantage in the use of cocks is that three-way and four-way flow control is possible.

(b) Cocks are used mainly in gas, compressed air, brine, refrigerant, petroleum product, and other moderate temperature fluid service, and serve best in full open or full closed positions. Gate valves also operate best in full open or full closed positions. Globe valves should be used for throttling fluid flow and may be operated in partially open position on water and steam systems.

2. When should I use a gate valve?

A gate valve is ideal for a no-flow setup but watch out for a service requiring frequent valve operation, which accelerates seat wear. A wedge disk type of gate valve is more difficult to repair than a globe valve. Other designs of disks in gate valves have lessened this problem. As a rule, do not use a gate valve for partial flow or too frequent operation.

3. When is it better to use a globe valve?

A globe valve is well suited for applications requiring regulation of flow, because the fluid flow is proportionate to the number of turns of the wheel. By contrast, a gate valve releases a variable amount with each turn. The second turn may release three times as much as the first, and the third, five times as much. Another point favorable to the globe valve is that the design of its seat and disk minimizes wire draw-

Tear out along this line
HPAC DATA SHEET

ing and erosion. And seats are resurfaced by reaming or grinding, and disks are comparatively easy to replace. This suggests lower maintenance costs where a wide range of flow control is wanted. But remember, a globe valve offers much more resistance to flow than a gate valve, and cuts down on line pressure. This may mean higher operating costs.

4. What is the story of different types of disks available in gate valves?

You have a choice of four types: solid wedge, flexible wedge, split wedge, and double disk. Because the solid wedge disk is a single moving part that will not jam because of misalignment of mating parts, regardless of its position — stem up, sidewise, or down — it is the most popular. It is ideal for steam service and well suited for water and many other fluids. Also, it is the best type for turbulent flow because it will not vibrate or chatter.

5. Why can't I standardize on the solid wedge disk gate valve?

You will run into trouble with it in high temperature service and where there are extreme temperature changes. Let's say the valve is closed when very hot. As it cools, the body contracts more than the disk, and the disk is sometimes pinched so tight it is hard to open. This jamming will not occur with the flexible wedge disk used in certain larger steel valves for high temperature service. That disk is solid through the center section, but not around the outer portion. Thus this construction is flexible and will not allow the disk to stick. You do not need a pry to turn the valve wheel.

6. When do I use a swing check valve instead of a lift check valve?

Generally, the lift check is used with globe valves, and the swing check with gate valves. Since the disk in a swing check is not attached to a stem, it opens wide when the moving fluid hits it. And gravity helps slam it shut when a reverse flow occurs. A lift check works the same as a globe valve, the amount of flow governs amount of opening. So you get full flow through a swing check, restricted flow through a lift check.

7. Does it matter whether I use a gate valve instead of a globe valve?

Yes. Each type has advantages and disadvantages that you need to watch. Contrasted with a globe valve, a gate valve when wide open offers little resistance to flow. But it is a poor choice for throttling service, because you should always operate it either in the all open or all shut position. If you do not, you subject the disk to undue strain from the pressure of the flow. And when the disk is in a cracked position, the continued high velocity of the fluid will cause severe wire drawing and erosion of the seating surfaces. And in an intermediate position, you invite galling or scoring of the seating surface on the downstream side or troublesome vibration or chattering of the disk.

8. What is the purpose of the split wedge and double disk types?

In both of these types, the wedges come in several parts. In a double disk valve, for example, the disks and body seats are perpendicular and parallel. As you tighten the valve after closure, the wedge or spreader forces the disks outward and hard against the body seats. The first opening turn releases the disks, and continued turns raise them clear of the seat openings. You can repair or reface such parallel seats more easily than those accommodating a tapered wedge disk.

9. Wouldn't it pay then to install the double disk type wherever possible?

No, for two main reasons. To assure proper valve closure, you usually cannot install a double disk valve with its stem below horizontal. Also, this valve is apt to vibrate in steam service, and cause the disk and seats to wear too fast. But it is good for pipe lines conveying liquids or noncondensing gases at normal temperatures.

10. Is it enough to specify a valve for a job by size and type?

No. There are other variations in valve parts that are important for getting the best service, such as type of disk, stem, bonnet, and stuffing box. Consider, for example, the types of seats and disks in a globe valve. The plug disk type is designed with a long tapered disk for tough throttling service, as in a blowoff soot blower, and boiler feedwater applications. The ordinary disk type with metal-to-metal seat contact works well in regular service, but will not close tight if a speck of hard foreign matter gets in between. In that case, the softer composition disk is ideal because it will yield at that spot. This disk is useful, too, for hard-to-hold fluids, such as compressed air. And being available in a variety of compositions, this type of valve can be made interchangeably serviceable for water, oil, air, gases, steam, and similar fluids. Finally, should the disk wear, you can easily replace it.

11. Do I have to consider the type of bonnet in the valve I order?

Certainly. The three most common types are: the bonnet with the screwed-in joint, the screwed-union ring type, and the bolted bonnet. The screwed-in bonnet is simplest and least expensive and is used where dismantling is infrequent. The screwed-union type is best where you expect frequent dismantling and reassembly. You use the costlier bolted bonnet joint for high pressures, regardless of size. Then there is the pressure seal type for the very highest pressures and temperatures.

12. What conditions affect my choice of the type of valve stem?

You do not always have a choice of every type of stem for every type of valve. But where you do, it pays to choose wisely. The rising stem and inside screw is common to the smaller sizes of gate and globe valves for ordinary service. You can also get a nonrising stem and inside screw in a gate valve. This is particularly useful where headroom is limited. In the rising stem type with outside screw and yoke, the stem threads are not subject to corrosion, erosion, sediment, or any elements in the pipe line fluid that could damage the threads. You can lubricate this thread easily. Also, you can tell at a glance from the position of the thread whether the valve is open or closed.

13. What other features of valve construction should I consider in selecting a valve?

There are various modifications in the stuffing box and packing that seals the stem, to meet different service conditions. Perhaps the most radical development along these lines is the packless diaphragm valve. It is ideal for hard-to-hold fluids, or wherever stuffing box leakage and consequent maintenance would be a serious problem. Then there is a choice of valve body metals — brass, bronze, cast iron, steel, and alloys — which is vital to good performance. Moreover, scores of different metals and alloys are used for valve trim. What metals you specify depends on the service. You do not use the same valve for high vacuum service in the pharmaceutical industry as for a 30,000 psi service in the plastics industry. The chemical industry requires a valve to work at temperatures lower than −175 F, whereas a valve in a steam generating station may have to operate at 1000 F or higher. The point is, there is one type and makeup of valve best suited for every job. To select it, you must know every detail of the operation and maintenance of the application. Only then can you derive and honestly weigh the facts and figures to get the lowest overall valve cost.

14. Why should a relief valve be tested for operation at each inspection?

Failure of a relief valve to operate on over-pressure and over-temperature has caused accidents involving thousands of dollars worth of damage. Trial operation reveals relief valve defects and saves lives and money. ≠

HEATING, PIPING & AIR CONDITIONING
AMERICAN SOCIETY OF
HEATING AND AIR-CONDITIONING ENGINEERS
Journal Section

The object of the Society is to advance the arts and sciences of heating, ventilating, cooling and air conditioning, and the allied arts and sciences, for the benefit of the general public, to encourage and conduct scientific research, and to cooperate with other organizations having the same or similar objectives.

Earth as Heat Source and Sink for Heat Pumps†

By D. M. Vestal, Jr.* and B. J. Fluker**, College Station, Tex.

SUMMARY — Results of an investigation of the earth at shallow depths as a heat source and sink for the heat pump are presented. Described are the experimental buried coils tested, the testing program conducted, the kind of data obtained, and the method of data analysis used. A buried coil design equation is derived. A discussion is included concerning this design equation.

Fifty-seven tests with both continuous and intermittent type runs were completed. Three separate U-shaped coils of ½-in., 1-in., and 2-in. diameter, each of 160 ft nominal length, buried horizontally 3 ft below the ground surface were tested. Coil operating temperatures ranged from 90 to 130 F where the earth acted as a heat sink while for heat source operation coil temperatures ranged between 20 to 45 F. The circulating fluid rate of flow produced Reynold's numbers from 1000 to 6000. Data from these tests, combined with data from laboratory tests of a wide variety of soils, were studied by dimensional analysis.

An equation evolved from the dimensional analysis studies forms the basis for the development of a heat pump buried coil design procedure. Reference is made to the complete proposed coil design procedure, published separately.

THE ATMOSPHERE, surface and ground water, and the earth itself are three principal media which may serve as the heat source and sink of a heat pump system.

Increased interest in the heat pump as a year 'round air-conditioning system has demanded that quantitative information on each of these media be obtained in order that a designer may make an engineering evaluation of the advantages and disadvantages of each for a particular installation. Each of the media and combinations of them have been studied by other investigators, listed in the Bibliography in the Appendix,‡ but no generalized design criteria were evolved. This paper presents the results from an extensive investigation of the earth at shallow depths as a heat source and sink for the heat pump and gives the buried coil design equation which was developed. Details of the design method based on this work were given previously.[1]

The operating characteristics of horizontally buried coils of ½-in., 1-in., and 2-in. diameter were observed and studied under controlled operating conditions. Data were obtained for both the cases where the earth acted as a heat source, and where it acted as a heat sink. Results were combined with data from laboratory tests of artificially prepared soil specimens and with field measurements of natural soil temperatures into a correlation from which the previously mentioned design equation and design procedure were developed.

Equipment and Apparatus

A plot plan of the field installation where the buried coil testing program was conducted is presented in Fig. 1.

†The data presented here were obtained in experiments conducted for the Texas Electric Service Co., Ft. Worth, by the Texas Engineering Experiment Station cooperatively with the Texas A. & M. Research Foundation.

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‡Planned to be included with this paper when published in TRANSACTIONS 1957.

[1]Exponent numerals refer to References.

Journal Section

Construction of the instrument house and installation of the first four coils, A, B, C and D, was begun in the spring of 1949. Each of the coils A, B, C and D was independent of the others and was buried horizontally 5 ft below the ground surface. Experimental work on these coils was initiated in November, 1949.

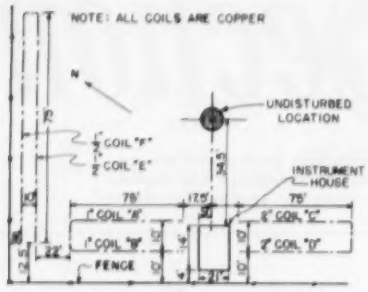


Fig. 1—Plot plan of field installation

When it became evident from data of the first 5 tests of these original 4 coils that the temperature change of the circulating fluid was too small to be measured accurately except at low rates of fluid flow, each pair of coils of like diameter was connected with a 10-ft long crossline. The coil length traveled by the fluid was thereby increased to a nominal 160 ft as shown in Fig. 1. All tests after the first 5 employed the *U*-shaped arrangement.

In the fall of 1951 the ½-in. diameter coils, designated E and F in Fig. 1, were added and were buried at the same depth as the other coils.

A schematic flow diagram of the field installation is shown in Fig. 2. Additional details of the equipment and apparatus employed are given in the Appendix under the heading *Details of Equipment and Apparatus.*

Test Procedure

Procedures followed in starting a test, in extending it over the desired period of time, and in ending it were standardized where possible for the bulk of the buried coil testing program. Early tests in which the fluid was circulated through only one coil 75 ft in length provided the basis for establishing many of the standard operating procedures. Others were modified or became standard as additional experience accumulated.

The general procedure followed in beginning a test run and in placing the buried coil into operation was as follows.

1. Selection of the Coil Pair to be Tested:—Selection of a coil pair was governed principally by the temperature pattern in the soil around the coil pair in question. Sufficient time was allowed between 2 series of tests on the same pair to permit the soil temperatures to approach their natural undisturbed values. The coil testing plan adopted in which a series of 3 test runs were completed on each of the 3 coil pairs in succession gave ample time for soil temperature recovery between series on the same coil.

2. Selection of the Coil Inlet Fluid Temperature to be Maintained Constant Throughout the Test Run:—For coil condenser type runs, the coil inlet fluid temperature was selected between the limits of 90 to 130 F while for coil evaporator runs the limits were from 20 to 45 F. In each type of test, the range included coil temperatures anticipated in the operation of an actual buried coil heat pump installation used for comfort space conditioning. Selection of either a condenser or an evaporator test was governed, as would be the case in an installation used solely for comfort space conditioning, by the seasonal variation of the outside air temperature. That is, circulating fluid temperatures in the winter months were selected in the lower temperature range to simulate coil evaporator operation while those selected for the summer months were in the upper temperature range to simulate coil condenser operation.

3. Selection of an Average Reynold's Number and Computation of the Corresponding Rate of Fluid Flow to be Maintained Constant Throughout the Test Run:—Normally, a series of 3 tests in succession were made on the same coil size at the same coil inlet temperature. Only the Reynold's number was varied between tests in a series. Values of 1000, 2500, and 5000, respectively, were approximated depending upon the ability of the controlling devices to hold a constant fluid temperature and rate of flow.

4. Selection of Either Continuous or Intermittent Coil Operation:—Fluid was circulated with no interruption through the buried coils for the duration of a continuous coil operation test. In those tests in which intermittent operation was employed, 3 different cycles were devised lasting 2 hours each. The 3 intermittent cycles were ¼ cycle on, designated Case I; ½ cycle on, designated Case II; and ¾ cycle on designated Case III. Two other cases, IV and V, combined these 3 basic intermittent cycles. Case IV cycle was composed of Cases I, II, and III in succession while Case V cycle was made up of Cases I, III, and II in that order. Each of the latter cases, as tests proved, was equivalent to ½ cycle on, designated Case II, and is reported as such.

The fraction of the cycle *on* refers to the initial part of the 2-hr period in which the fluid was circulated through the coil. During the remaining part of the cycle, the fluid flowed through only the coil bypass line and the particular common circuit involved in order to maintain flow rate and temperature for the next cycle. Switching of the fluid flow from coil to coil bypass line and back to the coil was accomplished by the simultaneous opposite action of 2 solenoid valves whose operation was controlled by an electric automatic on-off timer.

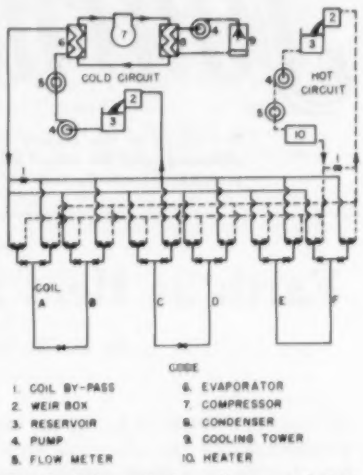


Fig. 2—Schematic flow diagram of field installation

5. Regulation of Valves in the Fluid Circuit to Route the Fluid Through the Desired Flow Path:—Only the manual shut-off valves routing the fluid through the coil pair in the desired direction were initially open. The fluid temperature and rate of flow were brought to their predetermined values by making necessary adjustments while circulating the fluid through the appropriate common circuit and corresponding coil bypass line. These conditions first being satisfied, the coil pair was then put into operation by simultaneously closing the bypass line solenoid valve and opening the inlet solenoid valve to the coil.

Prior to placing a coil pair into operation by the foregoing procedure, soil temperature measurements were made to obtain the before-test distributions in the soil surrounding the coil. The appropriate recording potentiometers were switched on immediately before beginning fluid circulation to record the initial temperatures of all thermocouple junctions located about the coil pair. Each potentiometer then remained in operation for the duration of the test run

and the soil temperature recovery period after the end of the run.

Soil moisture content determinations were made also just prior to the beginning of fluid circulation in each test. Borings in the ditch backfill vertically above each leg of the coil pair to be tested were made using a hand auger of either 1-in. or 2-in. diameter. Soil samples were taken at each ½-ft increment to a depth of 5 ft (coil depth). Longitudinal spacing of the borings above the operating coils was 18 in. These borings were continued daily through the duration of the test and soil temperature recovery period.

Additional borings were made before test, 2 ft to either side of the coil leg in the natural soil. The 2-in. auger was used for the side borings which were to a depth of 6 to 8 ft. Soil samples were taken at each ½-ft increment of depth. Only one side boring per week per coil leg of the operating pair was made during the test and the soil temperature recovery period after test.

Tests and Data

Of the 57 tests completed on the buried coil installation, 25 were simulated coil condenser type runs while 32 were simulated coil evaporator runs. The tests varied from 5 to 90 days duration. Both intermittent and continuous flow were investigated over a range of Reynold's numbers from 1000 to 6000 except for 2 runs which were below 1000 and 2 whose values were well above 6000. Fluid inlet temperatures investigated covered the range from 90 to 130 deg for simulated condenser type runs and from 20 to 45 deg for simulated evaporator runs. A mixture of ethylene glycol and water was circulated through the coils in all tests.

In Table 1 are listed all simulated coil condenser type runs with a summary of their operating conditions and results. Similarly, the coil evaporator type runs are tabulated in Table 2.

The run designation is given in column 1 of Tables 1 and 2. The initial buried coil test, a condenser type run, was designated run D-1 where D specified the coil tested and the numeral 1 indicated an initial test. Modification of the run designation was required for complete identification when the tests were changed from one coil of 75-ft length to 2 coil legs in series of 160-ft total length. Where 2 letters appear first in a run designation, those letters denote the coil pair tested, the first letter indicating the upstream leg. The numeral indicates the number of runs of that type operation involving a particular coil pair that have been made. A letter H following the numeral indicates a *hot* or condenser type run while a C indicates a *cold* or evaporator type run. Intermittent fluid flow where employed is denoted by the final letter I and a case number indicating the cycle of intermittent operation as defined earlier.

Column 5 gives the mean operating temperature of the coil during test. This temperature is the average of all arithmetic averages of the coil inlet and outlet temperatures at each computation of an instantaneous rate of heat transfer, q.

Column 6 is the computed mean Reynold's number of the circulating fluid in the coil during test. Each of the Reynold's numbers given are computed using the inside coil diameter, the average rate of fluid flow during the run, and the average fluid viscosity. The latter quantity in turn depended upon the average coil operating temperature given in column 5 and the average ethylene glycol concentration of the fluid.

Column 7 gives the difference between the mean coil operating temperature and the mean thermally undisturbed soil temperature at coil depth for the period of the test run.

In column 8 is given the mean values of a thermal coefficient of the soil immediately surrounding the operating coil. An experimental method, called the heat meter method,[1,3,4] was used to measure the thermal coefficients. Tests on 14 soils covering a wide range of soil types were completed in which thermal coefficients and thermal moisture migration data were obtained and correlated. The resulting correlation, was used to compute the soil thermal coefficients given in Tables 1 and 2.

In addition, column 10 in Table 2 gives the maximum radius of soil freezing in inches which was observed at the midpoint of the up-

Table 1 — Summary of Simulated Condenser Type Runs

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9) Ultimate Rate of Heat Transfer Btu/hr	
Run No.	Days Fluid Circulated	Date Fluid Circulation Stopped	Avg Fluid Inlet Temp °F	Avg Fluid Temp °F	Avg Reynold's No.	Avg Temp Diff. °F	Avg Soil Thermal Coefficient Btu/hr (sq ft) (°F/ft)	Per ft	°F Per ft
FE1H-I									
Case I	4.00	7 Jul 52	117.5	106.3	5443	26.4	0.79	64.0	2.42
Case II	2.00	9 Jul 52	118.4	108.0	5507	27.0	0.79	54.0	2.00
Case III	1.00	10 Jul 52	118.4	109.3	5012	28.5	0.78	42.0	1.48
FE1H	7.00	4 Sep 52	125.3	119.3	6861	32.0	0.77	15.3	0.48
FE2H	7.00	11 Sep 52	122.7	121.6	31597	35.0	0.76	15.0	0.45
FE3H	15.25	10 Oct 52	120.9	119.3	16774	35.9	0.75	18.0	0.50
1BH	17.00	11 May 50	120.0	114.8	2050	49.9	0.65	50.0	1.00
BA1H	7.00	18 May 51	130.1	115.7	2210	59.8	0.75	47.1	1.18
BA2H	7.00	30 May 51	130.1	120.2	3790	41.6	0.72	47.6	1.14
BA3H	7.00	6 Jun 51	130.1	123.8	6400	43.4	0.71	47.8	1.10
BA4H	15.00	8 Aug 51	99.3	95.9	2310	8.2	0.89	10.0	1.22
BA5H	7.00	15 Aug 51	99.5	98.4	3480	9.5	0.88	2.0	0.21
BA6H	7.00	22 Aug 51	100.4	100.0	6260	11.7	0.88	2.0	0.17
BA1H-I									
Case I	14.08	10 Jun 52	120.2	110.3	5532	56.6	0.73	95.0	2.60
Case II	5.92	16 Jun 52	120.9	114.3	5473	59.5	0.72	68.0	1.72
Case III	5.00	21 Jun 52	120.7	116.0	5414	59.8	0.72	47.0	1.18
D-1	30.00	16 Dec 49	120.0	111.2	1009	40.5	0.71	46.1	1.14
1DH	30.00	4 Mar 50	120.0	112.1	1050	50.8	0.65	57.0	1.12
1CH	20.92	27 Jun 50	120.0	115.3	1150	42.9	0.69	46.0	1.07
DC1H	5.77	12 Jun 51	130.1	117.1	1590	52.8	0.75	52.0	1.59
DC2H	7.00	22 Jun 51	129.7	122.7	2900	59.5	0.73	46.0	1.17
DC3H	7.00	29 Jun 51	129.9	126.5	5950	60.1	0.74	47.0	1.17
CD1H	9.71	9 Jul 51	130.1	121.5	1700	54.2	0.76	56.0	1.05
CD2H	7.00	16 Jul 51	130.3	124.3	3180	60.7	0.75	60.2	0.99
CD3H	15.00	31 Jul 51	129.6	126.9	6470	60.9	0.75	61.0	1.00
DC4H	16.00	7 Sep 51	100.4	96.8	1250	4.0	0.90	15.0	3.75
DC5H	17.00	24 Sep 51	109.4	107.6	2468	12.0	0.82	22.0	1.83
DC6H	21.55	10 Oct 51	110.8	109.0	5256	13.8	0.81	15.0	1.09
DC1H-I									
Case I	19.00	5 Aug 52	115.7	110.8	5979	28.8	0.78	90.0	3.13
Case II	7.08	12 Aug 52	118.4	115.3	5647	31.6	0.77	61.0	1.93
Case III	6.00	18 Aug 52	119.8	117.9	6062	32.8	0.77	35.0	1.07

stream coil in runs where the mean fluid temperature in the coil was below 32 F.

Data Analysis

Dimensional analysis was utilized to obtain a correlation of data from the tests. Five preliminary attempts were made before an acceptable correlation evolved from the dimensional analysis study. Variables which were isolated and evaluated during a test run and which were incorporated into the final correlation were:

$$\theta, Q, \Delta T, k, \rho C_p, L, D.$$

As applied to the work of this project the definitions of these quantities are as follows:

- θ = hours of operation elapsed after the beginning of fluid circulation through a coil pair.
- Q = the total instantaneous rate of heat transfer in Btu per hr between the circulating fluid and soil at time θ.
- $\Delta T = |t - t_s|$, the instantaneous absolute difference in Fahrenheit degree between the average fluid temperature, t, in the coil at time θ and the ambient soil temperature, t_s, at coil depth (5 ft) averaged over the entire operating period of the run.
- k = a thermal coefficient in Btu per (hr) (sq ft) (deg F per ft) of the soil at the buried coil surface averaged over the entire operating period of the run.
- ρC_p = the volumetric specific heat in Btu per (cu ft) (deg F) of the soil at the coil averaged over the entire operating period of the run. ρ is the wet density of the soil around the coil while C_p is the wet soil heat capacity.
- L = the effective length in feet of the coil or coil pair being tested.
- D = the coil inside diameter, feet.

The final dimensionless grouping of the above variables was

$$(Q/\Delta TkL) \text{ and } (k\theta/\rho C_p D^2).$$

Similar groups were obtained by Hadley,[3] but his definitions of certain of the variables are different from the definitions used here. Differences occur in the definition of the rate of heat transfer, Q, the temperature difference, $\triangle$T, and the time, θ.

Figure 3 is a plot of group $(Q/\triangle TkL)$ versus group $(k\theta/\rho C_p D^2)$ for all continuous operation simulated condenser type runs. The ordinate of this curve decreases monotonically. The large initial values of the ordinate corresponded to high rates of heat transfer immediately after beginning fluid circulation through the coil pair. An approach to stabilized soil temperature and heat flow conditions was observed as the abscissa increased. The steady-state conditions approached are represented in Fig. 3 by the level portion of the data.

If only the horizontal part of the data in the plot is considered, then the ordinate is independent of the group $(k\theta/\rho C_p D^2)$, or

$$Q/\Delta TkL = I \quad \ldots\ldots\ldots\ldots\ldots (1)$$

Rearranging the expression, the effective buried coil length is found to be

$$L = Q/\Delta TkI \quad \ldots\ldots\ldots\ldots\ldots (2)$$

where

I, called the *intermittency factor*, is a function of the fraction of unit time that fluid is circulating through the coils and is equal to the level value of ordinate approached in the plots of dimensionless groups.

Similar plots of the same 2 dimensionless groups were made for the continuous simulated evaporator type runs and for each of the 3 cases of intermittent operation. Equation 1 was found to apply in every instance with the value of the intermittency factor, I, increasing as the fraction of unit time *on* decreased. Figs. 4a and 4b show the empirical relationship found between I and the intermittency ratio for condenser and evaporator type runs, respectively. Note that an intermittency ratio of 1.0 represents continuous operation.

Table 2 — Summary of Simulated Evaporator Type Runs

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)		(10)
Run No.	Days Fluid Circulated	Date Fluid Circulation Stopped	Avg Fluid Inlet Temp °F	Avg Fluid Temp °F	Avg Reynold's °F	Avg Temp Diff, °F	Avg Soil Thermal Coefficient Btu/hr (sq ft) (°F/ft)	Ultimate Rate of Heat Transfer Btu/hr		Max Radius of Soil Freezing
								Per ft	°F Per ft	
FE1C	5.00	15 Jan 52	35.6	40.1	1698	25.7	1.00	19.0	0.74	—
FE2C	7.79	23 Jan 52	35.2	36.7	5925	29.0	1.00	21.0	0.72	—
FE3C	8.00	8 Feb 52	30.0	33.8	2206	34.0	1.00	25.0	0.74	—
FE1C-I										
Case I	4.00	12 May 52	44.6	52.3	1785	17.4	1.00	35.0	2.01	—
Case II	2.00	14 May 52	39.2	45.9	1898	24.9	1.00	32.0	1.29	—
Case III	1.00	15 May 52	41.9	47.3	1873	24.3	1.00	27.0	1.11	—
FE4C	5.00	23 Feb 53	23.2	29.3	1213	33.7	1.00	31.5	0.93	—
FE5C	5.00	28 Feb 53	20.8	24.4	2732	38.0	1.00	37.0	0.97	—
FE6C	5.00	5 Mar 53	24.8	26.6	4064	35.2	1.00	35.0	0.99	—
FE2C-I										
Case I	4.00	14 Apr 53	25.7	27.3	4391	40.3	1.00	45.0	1.12	Unknown
Case II	2.00	16 Apr 53	25.4	26.5	4446	41.7	1.00	35.0	0.84	Unknown
Case III	1.00	17 Apr 53	26.6	27.4	4590	41.1	1.00	31.0	0.75	Unknown
BA1C	9.00	2 Feb 51	33.8	40.1	734	25.0	1.00	22.0	0.88	—
BA2C	7.00	13 Feb 51	33.8	38.3	1091	23.9	1.00	20.0	0.84	—
BA3C	7.00	28 Feb 51	33.8	36.7	1640	24.7	1.00	20.0	0.81	—
BA4C	6.00	7 Mar 51	33.8	38.3	4695	25.1	1.00	20.0	0.80	—
BA1C-I										
Case I	7.00	28 Feb 52	33.1	39.4	1475	25.5	1.00	58.0	2.27	—
Case II	7.00	6 Mar 52	33.1	37.6	1442	27.3	1.00	42.0	1.54	—
Case III	7.00	13 Mar 52	33.4	36.6	1442	28.3	1.00	30.0	1.06	—
BA5C	7.00	13 Dec 52	19.9	24.8	1191	44.1	1.00	41.0	0.93	0.00″
BA6C	7.00	20 Dec 52	23.0	24.8	2876	42.3	1.00	39.0	0.92	2.50″
BA7C	10.00	12 Jan 53	24.4	25.2	5216	38.9	1.00	37.0	0.95	3.00″
BA2C-I										
Case I	8.00	30 Apr 53	22.8	24.5	4124	43.9	1.00	104.0	2.37	1.00″
Case II	7.00	7 May 53	19.4	20.8	4124	49.5	1.00	87.0	1.76	2.00″
Case III	7.00	14 May 53	21.6	22.5	4136	48.4	1.00	55.0	1.14	2.75″
1DC	8.00	21 Dec 50	33.8	34.2	245	38.3	1.00	30.0	0.78	—
DC1C	7.00	22 Mar 51	33.8	36.5	1030	28.5	1.00	26.5	0.93	—
DC2C	7.00	3 Apr 51	39.2	41.0	2560	30.2	1.00	34.8	1.15	—
DC3C	8.92	21 Apr 51	40.1	41.0	4700	29.0	1.00	36.5	1.26	—
CD1C	8.96	30 Apr 51	45.5	46.4	1240	22.8	1.00	16.2	0.71	—
CD2C	4.90	5 May 51	45.5	46.4	3090	27.8	1.00	19.2	0.69	—
CD3C	34.00	26 Nov 51	41.0	42.8	5256	20.3	1.00	30.0	1.48	—
DC1C-I										
Case I	17.00	13 May 52	35.2	40.3	1306	25.7	1.00	87.0	3.39	—
Case II	8.00	21 May 52	33.6	36.8	1323	30.6	1.00	56.0	2.18	—
Case III	6.00	27 May 52	34.2	36.7	1315	31.3	1.00	38.0	1.21	—
DC4C	10.00	20 Mar 53	26.1	27.9	1491	34.9	1.00	33.0	0.95	0.00″
DC5C	10.00	30 Mar 53	21.9	23.4	1949	41.0	1.00	31.0	0.76	2.75″
DC6C	10.00	9 Apr 53	21.9	22.5	3741	43.6	1.00	28.0	0.64	4.50″
DC2C-I										
Case I	16.00	7 Jun 53	29.1	31.9	4955	40.2	1.00	91.0	2.26	—
Case II	8.00	15 Jun 53	32.8	34.2	4890	40.9	1.00	69.0	1.69	—
Case III	6.00	21 Jun 53	38.5	39.4	4769	37.5	1.00	57.0	1.52	—
BA8C	90.88	28 Jan 54	21.2	23.0	2345	47.7	1.00	37.0	0.78	4.50″
BA8C-I										
Case I	12.00	9 Feb 54	21.7	23.7	2754	40.1	1.00	83.0	2.07	0.50″
Case II	11.00	20 Feb 54	22.1	23.2	2773	41.2	1.00	45.0	1.09	1.75″
Case III	10.00	2 Mar 54	21.9	25.5	2754	39.7	1.00	31.0	0.78	2.50″

The Buried Coil Design Equation

Equation 2 formed the basis around which a design procedure for a buried coil heat source and sink for the heat pump was developed. The expression is the result of experimental data compiled from tests on 3 relatively short lengths (160 ft) of buried coil.

The variables Q and ΔT were computed from quantities measured during test while I was an empirically determined dimensionless number. Evaluation of k was by means of an equation which resulted from laboratory tests of artificially prepared soil samples. The equation for k given here without derivation[1,3,4] is

$$k = a\left(\frac{t}{t_r}\right)^{\frac{0.29}{d+1}} (S_r)^{0.29} \quad \text{.....(3)}$$

where

k = soil thermal coefficient corresponding to the stabilized soil condition established during coil operation.

S_r = initial or reference degree of saturation of the soil.

t = average fluid temperature in the coil, Fahrenheit degrees.

t_r = average ambient soil temperature at coil depth, Fahrenheit degrees.

and

a and d = empirical constants.

If the expression for k given by Equation 3 is substituted into Equation 2 together with $\Delta T = (t - t_r)$, the final form of the design equation is

$$L = \frac{Q}{\left[a\left(\frac{t}{t_r}\right)^{\frac{0.29}{d+1}} (S_r)^{0.29}\right](t-t_r)I} \quad \text{.....(4)}$$

Thus, a buried coil for the heat pump may be designed from a knowledge of the total coil load, Q, the mean coil operating temperature, t, a reference soil temperature, t_r, the initial degree of saturation of the soil at coil depth, S_r, and 3 empirical constants, a, d, and I.

The design consists of an evaluation of these quantities followed by a solution of the equation for the coil length L. This length must then be modified to suit the particular coil configuration employed[1].

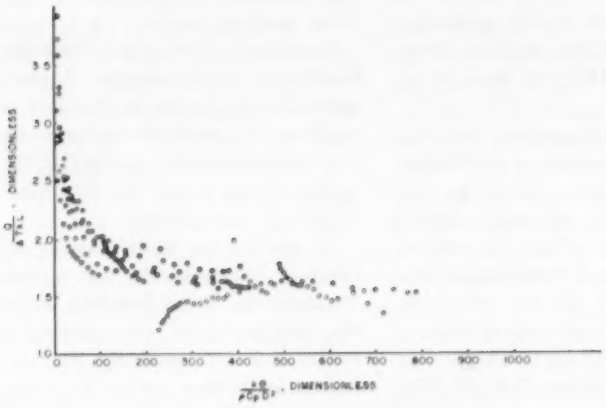


Fig. 3 — Dimensional analysis correlation of data of buried coil condenser runs, continuous operation

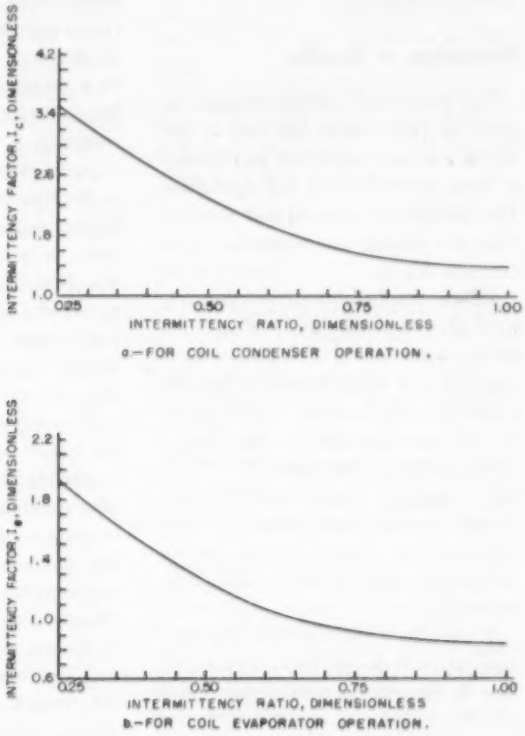


Fig. 4 — Empirical relationships of the intermittency factor with the coil intermittency ratio

Buried Coil Configurations

In practice, the ground surface area under which a coil is to be buried may be too small to permit installation of a coil arrangement where each leg is thermally isolated from the others. A solution to the problem would be to space adjacent coil legs closer than the minimum separation required for thermal isolation. In this case the influence of each leg upon adjacent legs will reduce the rate of heat transfer between soil and fluid per linear foot of buried coil, thus necessitating a greater coil length than that given by Equation 4 to meet a specific load. No experimental investigation of thermal interference was attempted but a theoretical analysis of the problem described in the Appendix served as the basis for including in Equation 4 a ratio to account for thermal interference between coil legs.

Values of R and R' which are called configuration factors (see Appendix for the derivation of equations for these factors) were computed for various configurations and are given in tabular form in the proposed buried coil design procedure[1]. The reciprocal of the appropriate configuration factor, depending upon whether one or two coils per ditch are

used, multiplied by design Equation 4 will result in a coil length increased sufficiently to make up for the heat transfer reduction due to the effects of thermal interference between adjacent coil legs.

Discussion of Results

The buried coil design equation as given is valid where the soil is unfrozen and also where the soil freezes to some extent during coil operation. The maximum radius of soil freezing observed during an evaporator type run was 4.5 in.

Effects attributable to soil freezing were observed only for a short time at the beginning of a test. All evaporator runs in which the operating temperature was below the freezing point of soil were included in the dimensional analysis plot. Data from these soil freezing runs corresponded closely to data from nonfrozen runs following the initial period during which the radius of soil freezing was increasing.

It may be noted that coil diameter and material do not enter into Equation 4. Data from tests of all 3 coil sizes were included in the final analysis. No distinction between data of different coil sizes was evident, indicating that the effect of coil diameter was negligible. The design equation is considered applicable, therefore, to coil sizes from ½ to 2 in. in diameter. No coil diameter outside this range and no coil of material other than copper was used in the tests.

The rate of fluid flow was such that the average Reynold's number exceeded 1000 in all but 2 test runs. Data from these 2 runs, 1DC and BA1C, were excluded from the plots of dimensionless groups. Because of the increased difficulty in maintaining a constant rate of fluid flow at low Reynold's numbers and in view of the decreased accuracy in recording fluid inlet and outlet temperatures at relatively low rates of flow, the Reynold's number was maintained above 1000 for all other tests. This value is recommended as the minimum to be used in coil design where the data from this work are used.

It must be emphasized that only one fluid was circulated through the buried coils in all tests. A liquid solution of ethylene glycol in water was used exclusively, and the solution experienced no change of phase while traversing the coil. For the results of this work to be strictly applicable to a design problem, the fluid circulated through the coil must be a liquid.

Justification for applying the data to the flow of a boiling or condensing liquid refrigerant as would be the case in a direct expansion system was found in a study of the coil internal and external heat transfer film coefficients.[5,6,7,8] In the coil tests studied where liquid was circulated, the ratio of the inside to outside film coefficient was greater than 10. This difference in magnitude rendered negligible the influence of the inside film coefficient upon the overall heat transfer coefficient. Further, for boiling or condensing dichlorodifluoromethane the average inside film coefficient was computed by the method of Baker, Touloukian and Hawkins[6] and was found to be larger than those determined for the water-ethylene glycol solution assuming the same rate of heat flow per unit inside surface area for both types of flow.

These findings show that the results of this work may be applied to the design of a buried coil where either a liquid or where boiling or condensing dichlorodifluoromethane is circulated. The foregoing analysis also confirmed the fact which was indicated by the dimensional analysis study that no upper limit of Reynold's number should be placed on the data. The inside film coeffcient for the types of flow discussed normally increases with Reynold's number. An increase in Reynold's number would further decrease the already negligibly small influence of the inside film coefficient upon the rate of heat transfer between the fluid and the surrounding soil.

The absolute difference, ΔT, between average coil temperature and ambient soil temperature should be maintained at 25 F or greater in an installation. During runs BA4H, BA5H, BA6H, DC4H, DC5H, and DC6H in which ΔT was well below that value, difficulty was encountered in measuring the small drop in fluid temperature across the coil. Very erratic heat flow values were computed for those 6 runs, and their data were omitted in the final dimensional analysis plot.

Reliability of the result from the buried coil design equation depends upon the evaluation of the factors applying to a particular design problem and also on the accuracy of the measured data used in the dimensional analysis correlation.

An analysis was made of the errors involved in measuring the various quantities in design Equation 2. In the observation of data during a buried coil test, seemingly small inherent instrument errors were encountered in the measurement of coil inlet and outlet fluid temperatures. All thermocouples at the field site were calibrated before installation in a constant temperature bath, the temperature of which was measured with a mercury-in-glass thermometer of known calibration. It was found that the differences, Δt, between junction temperatures of coil inlet and coil outlet thermocouples could be measured correctly to $\pm$ 0.18 F (or $\pm$ 0.1 C) at the temperature levels employed in the coil testing program. The estimated percentage error in measuring Δt through all the field runs, based on $\pm$ 0.18 F was $\pm$ 4.0 percent. And the percentage error would appear to be no greater than $\pm$ 2 percent in each measurement of the instantaneous rate of fluid flow. For the majority of runs an even smaller error was involved.

Assuming that the error in the value of fluid heat capacity, c, may be neglected, and by examining the equation

$$Q = w\ c\ \Delta t$$

it may be seen that an error in each computation of instantaneous rate of heat transfer, Q, was $\pm$ 6 percent.

If Q is correct to $\pm$ 6 percent, ΔT is correct to $\pm$ 4 percent, and k and L are considered without error, then

the estimated error in the dimensionless group $Q/\Delta TkL$ is $\pm$ 10 percent. The analysis is applicable to intermittent as well as continuous coil operation. In obtaining the basic design Equation 2, the dimensionless group $(Q/\Delta TkL)$ was equated to a constant, which was called the intermittency factor I. Thus, the error in I for any one test run is identical to that for the group. An independent check of the average deviation of I from a mean value for all continuous operation runs was computed to be $\pm$ 9 percent. As the fraction of coil operation per unit time decreased this average deviation increased.

For design purposes, the values of I plotted in Figs. 4a and 4b were selected with the intention that the resulting computed coil length be adequate during periods of extreme loads without auxiliary equipment to provide supplementary heating or cooling. The values of I plotted were the most reasonable values near the lower limit of the range of I corresponding to each type of test and cycle of operation.

Coil design for extreme ambient temperature conditions was the primary consideration in evaluating the reference soil temperature. An investigation of published weather station data indicated the greatest need for cooling occurred consistently in the months of July and August and the largest heating requirements were in January and February. The most unfavorable soil temperature conditions were found to occur in the months of August and February.[3] Thus, to perform satisfactorily during those extreme periods the reference soil temperature, t_r, was taken as the mean soil temperature at coil depth during August and February for coil condenser and evaporator operation, respectively.

The development of Equation 2, which resulted from the dimensional analysis of the operating coil data, into the usable buried coil design Equation 4 involved data correlations from laboratory soil heat transfer tests and thermal moisture migration phenomena investigations. These correlations were expressed in Equation 3 for the evaluation of a soil thermal coefficient in terms of the initial soil condition, the ratio of mean coil operating temperature to a reference soil temperature, and 2 constants. The reliability of Equation 3 in actual practice depends largely upon the accuracy with which the properties of the soil at coil depth are known. Emphasis is placed on the fact that standard procedures should be followed by an experienced field crew where possible in making density measurements and in obtaining soil samples at the proposed buried coil site. It is recommended that the soil index properties, liquid limit and plastic limit, which are related to the constants a and d be measured by experienced soil technicians[1].

The refrigeration machine condenser and evaporator capacities are required in the design equation. Also, the heat loss during the winter season and the heat gain during the cooling season of the space to be conditioned must be computed. The procedures recommended to find the heat loss or gain are those of ASHAE. Values determined by these methods, in general, are conservative. Manufacturers ratings at specified operating conditions of a given piece of equipment are normally *safe* values to use in sizing equipment for the job. In actual practice, however, variations in operating characteristics will occur causing a corresponding change in equipment capacity.

Because the accuracy of various site and operating equipment quantities necessary to the design of a buried coil cannot be estimated, the constants in Equation 4 were selected such that the coil length given by Equation 4 will tend to be slightly oversized.

As pointed out previously, no experimental investigations have been conducted to verify the configuration factors. It is thought, however, that these also will produce conservative coil lengths.

Acknowledgement

This paper was prepared by B. J. Fluker while D. M. Vestal, Jr. was on leave of absence. Mr. Vestal acted as consultant concerning questions which arose during the preparation of the paper.

Acknowledgment is made of the excellent foremanship of J. W. Overall, Jr., in the performance of the test work and in the collection of data described and presented in this paper.

Acknowledgment is given also to those students of the A. & M. College of Texas who assisted in all phases of work of this project.

References

1. A Proposed Procedure for the Design of a Heat Pump Buried Coil, by D. M. Vestal, Jr. and B. J. Fluker (Preliminary Copy, Texas Engineering Experiment Station, College Station, Texas, September 24, 1954).

2. Operating Characteristics of Heat Pump Ground Coils, by W. A. Hadley (*Edison Electric Institute Bulletin*, Vol. 17, No. 12, pp. 457-461, December 1949).

3. A future paper is planned which will present the natural soil temperature data collected by the project. Another paper will be prepared dealing with the soil thermal conductivity work conducted while a third paper will describe the moisture migration studies made. Data for the latter two papers were observed in laboratory tests of artificially compacted specimens covering a wide range of soil types.

4. A Comparison of the Values of Thermal Conductivity of a Dry Porous Material Determined by Various Laboratory Methods, by B. J. Fluker (*Thesis*, A. & M. College of Texas, College Station, Texas, 1953).

5. Heat Transfer Film Coefficients for Refrigerants Boiling Inside Tubes, by Merl Baker, Y. S. Touloukian and G. A. Hawkins (Paper presented at 40th Semi-Annual Meeting of *ASRE*, June 28-July 1, 1953, pp. 21-26).

6. Heat Transfer Rates to Evaporating Freon-12 in a Horizontal Tube Evaporator, by W. F. Witzig, G. W. Penny and J. A. Cyphers (*Refrigerating Engineering*, Vol. 56, No. 2, pp. 153-157, 1948).

7. Vaporization Inside Horizontal Tubes, by W. H. McAdams, W. K. Woods and R. L. Bryan (*Transactions ASME*, Vol. 63, No. 6, p. 545, 1941).

8. Heat Transfer Notes, by L. M. K. Boelter, V. H. Cherry, M. S. Johnson and R. C. Martinelli (University of California Press, 1946, pp. XV-1 to XV-8).

The President's Page

Council Actions at Washington Meeting

A detailed reporting of the Semi-Annual Meeting held in Washington, D.C., is covered elsewhere in the Journal, but the thought occurred to me that the members would be interested to learn of some of the actions which took place at the Council Meeting on Sunday, June 17.

As a result of concurrence by the Standards Committee, the Council approved a new official definition for air conditioning as follows:

> Air-conditioning is the process of treating air so as to control its temperature, humidity, cleanliness and distribution to meet the requirements of the space.

Council authorized the Standards Committee to accept an invitation for the Society to act as a sponsor on a new ASA project on Application Standards for Thermal Insulating Materials.

On invitation of ASA, Council also instructed the Standards Committee to participate in ASA projects dealing with the development of testing and rating procedures for factory-assembled and field-assembled cooling towers.

Based on the recommendation of the Regions Central Committee, the Council approved granting the 64th Charter for a Society Chapter to the Quad-Cities group, which includes Moline, Rock Island and Davenport.

A schedule of Chapters Regional Committee meetings for the Spring of 1957 was announced as follows:

Region	Location	Region	Location	Region	Location
1	Albany, N.Y.	4	Los Angeles, Calif.	6	Tulsa, Okla.
2	Detroit, Mich.	5	New Orleans, La.	7	Ottawa, Canada
3	Kansas City, Mo.				

Dates for these meetings are still being arranged, but it is expected that all will be held at as early a date as practicable.

Approval was given to the Operational Guide, submitted by the Wisconsin Chapter, for the Gustus L. Larson Award Committee. The Honors and Awards Committee also announced granting of the ASHAE-Homer Addams Award to an eligible student at the University of Minnesota for the year 1956.

Properly endorsed resumes of nominees for Fellow Grade were referred to the Membership Committee for evaluation and recommendation at the next meeting of Council, October 21.

Acting in accordance with the By-Laws of the Society, Council selected 5 nominees for the Committee on Research.

Authorization was given the Public Relations Committee to arrange for a press conference at the next Annual Meeting of the Society and plans were reviewed for the ASHAE exhibit at the 1957 Exposition which will feature research, publication and membership activities of the Society.

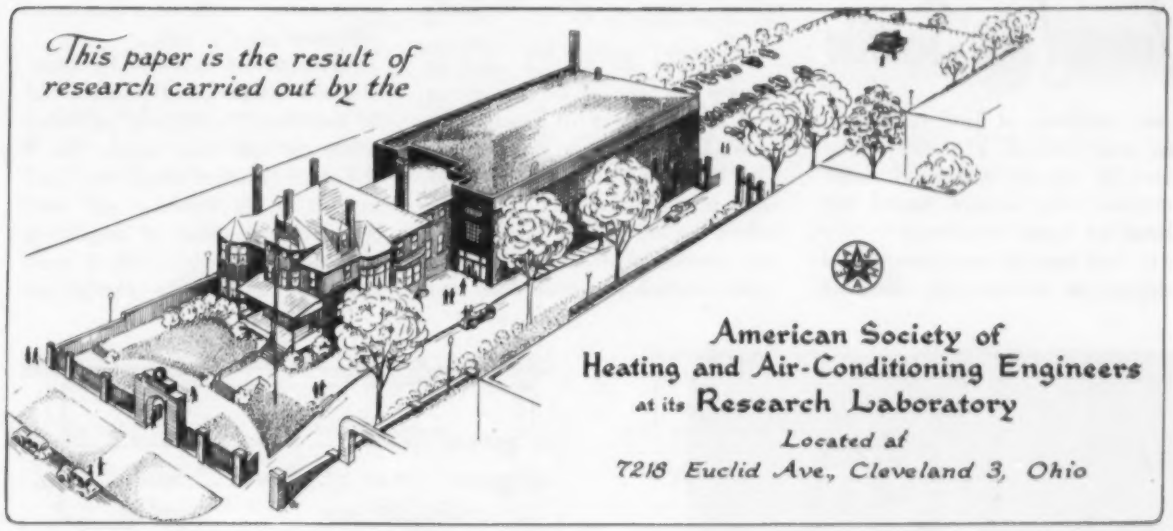
Future meetings of the Society were confirmed according to the following schedule:

1957	63rd Annual Meeting and Exposition, Chicago, Ill.	February 25-March 1
1957	Semi-Annual Meeting, Manoir Richelieu, Murray Bay, Que., Can.	June 24-26
1958	64th Annual Meeting, Pittsburgh, Pa.	January 27-29
1958	Joint Meeting ASHAE and ASRE, Minneapolis, Minn.	June 23-25
1959	65th Annual Meeting and Exposition, Philadelphia, Pa.	January 26-30

John W. James

President

American Society of Heating and Air-Conditioning Engineers


This paper is the result of research carried out by the
American Society of Heating and Air-Conditioning Engineers
at its Research Laboratory
Located at
7218 Euclid Ave., Cleveland 3, Ohio

Cold Wall Effects in a Ceiling-Panel-Heated Room

By L. F. Schutrum* and T. C. Min**, Cleveland, Ohio

SUMMARY: The room-side temperature of a wall or all-glass wall exposed to winter outdoor conditions affects the air temperature, the air movement, and the radiant conditions within the room. In a test room heated by a ceiling panel, one whole wall was cooled to simulate the inside temperature of an exposed wall. The ceiling was heated in panels 4, 8, and 12 ft wide and the panel temperatures selected to maintain a constant 70 F room-air temperature. Room-air temperatures, air velocities, and mean radiant temperatures were measured under steady-state conditions and are reported.

In the living space, variations in room-air temperatures were found to be small; and room-air velocities were negligible except near the floor. Mean radiant temperatures were in general higher than the room-air temperature.

THIS report concerns the combined effect of a cold wall or window and a heated ceiling panel on room-air temperature, mean radiant temperature (MRT) and air motion. All 3 of these factors are known to influence human comfort, but at present there is no accepted method of evaluating their combined effect.

Tests were made with heated panel areas near the cold wall to determine the extent to which such an arrangement could increase the air temperature and the radiant temperatures near the cold surface.

A project will be undertaken at the Research Laboratory of the Society in the near future to determine the effects of radiation and other environmental factors on human comfort. When these studies are completed, the data presented in this paper can be evaluated in terms of comfort effects.

How Investigation Was Made

Late in 1955, the Society undertook studies of the cold wall effect as an extension of the long-range research program which has been guided since its inception in 1947 by the Technical Advisory Committee on Panel Heating and Cooling*.

The ASHAE Environment Room[1] in which the tests were made is 24-½ ft long, 12 ft wide, and 9½ ft high (7.5 × 3.7 × 2.9 m). The room is described and illustrated in Reference 1. All surfaces of the room are composed of aluminum panels through which liquid at any desired temperature can be circulated. Surface temperatures are measured by about 400 copper-constantan thermocouples, and heat flow through the surfaces is determined by plate-type heat-flow meters[2].

Measurements of room-air temperatures and velocities, room-surface temperatures, radiation, and heat flow were made under steady-state

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[1]Exponent numerals refer to References.

room conditions of fixed ventilation, one cold sidewall, a heated ceiling panel of various widths, all other surfaces being neither heated nor cooled by liquid circulation.

In each test the entire area of one long wall of the room was controlled at a selected temperature, while the temperature of the heated section of the ceiling was adjusted to maintain a room-air temperature of 70 F (21 C). The temperatures of the cold wall were selected arbitrarily to cover the range of room-surface temperatures found in practice. The ceiling panel was adjacent to and the full length of the cold wall, and was 4 ft, 8 ft, or 12 ft in width (1.2, 2.4, and 3.7 m). The latter constituted the whole width of the ceiling. The floor, the other 3 walls, and the unheated portions of the ceiling were valved-off from the circulating temperature-controlling fluid and thus reached an equilibrium temperature resulting from the radiation and convection exchanges in the room and the heat exchange at the back of the panels. The temperature of the air behind the panels was controlled at approximately 70 F (21 C), and because the backs of all panels were insulated, the uncontrolled walls, floor, and sections of the ceiling were in effect, thermally neutral.

Ventilation air for 1.5 room-air changes an hour (0.25 cfm per sq ft of floor area) at 70 F was introduced into the room through two 8-in. (20.8 cm) ceiling diffusers located in the center section of each half of the ceiling. The throw of air was directed horizontally from the diffusers which protruded 2 in. from the ceiling. The air left the room through a long-narrow slot located between the floor and the wall opposite the cold wall. The dew-point temperature of the room air was maintained below the temperature of the cold wall to prevent condensation. The temperature of the cold wall was essentially uniform.

To determine the temperature variation which would occur on a wall not directly controlled by fluid circulation, one test was made with one-half of the cold wall covered with an inner wall of double-strength glass spaced about 4 in. away from the cold wall and extending from floor to ceiling. This glass wall may be seen in Fig. 1.

Room-air temperatures were sensed by 36-gage copper-constantan butt-welded thermocouples which were found not to be appreciably affected by radiation. Room-air velocities were measured with a commercial heated-wire type anemometer and verified by a heated-thermocouple anemometer[3], both of which were calibrated prior to use.

Radiation was measured by means of globe thermometers[4,5] and a flat 2π radiometer[6] which was calibrated before the tests were begun. The 3 globe thermometers which were used were 6 in. in diameter and were coated with a mixture of lamp black and shellac having a normal emissivity of 0.95[7]. The equilibrium globe temperatures result from a balance between radiation gain and the convection loss.

The 2π radiometer was set up at several locations in the room, and in each location, a reading was taken normal to each of the 6 room surfaces. From the directional radiant temperatures thus obtained the mean radiant temperatures were calculated.

An indicating electronic potentiometer having an emf scale and a special direct-reading temperature scale was used to measure the electrical output of thermocouples, heat-flow meters, radiometers, and one of the anemometers.

The test room was unlighted and unfurnished, and was unoccupied except when air temperature, globe thermometer, radiometer and anemometer readings were being taken. During these readings it was necessary for one person working by flashlight, to be in the room to position the instruments.

Fig. 1—View of glass wall in test room

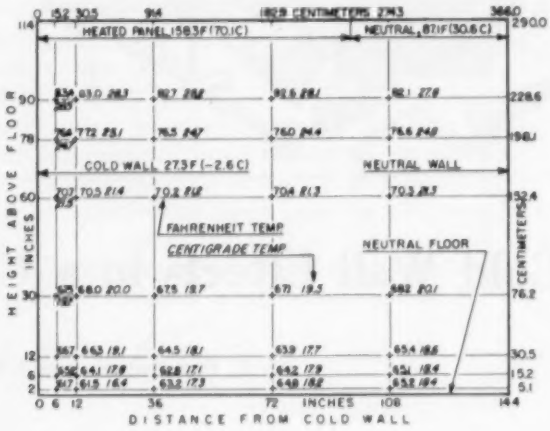

Fig. 2—Room-air temperature distribution, center of room, cold wall 27.3 F (−2.6 C), test No. 510

Test Results

Table 1 presents a summary of room-surface temperatures, air temperatures and panel areas for all of the tests. The air temperatures given in this table were taken with the room unoccupied. All other air temperatures given in the papers for the same location were taken with one occupant in the room, and are slightly higher because of this occupancy.

The highest panel temperatures and the lowest cold-wall temperatures given were used for Laboratory purposes only to establish the trends of the factors, and should not necessarily be regarded as good practice for producing comfort conditions.

Room Air Temperatures

The distribution of the room-air temperatures in a plane through the center of the room is shown in Figs. 2, 3, and 4 for three combinations of cold-wall and panel temperatures. Air-temperature measurements were also made in planes 6 ft and 1 ft away from an end wall, and were found to be essentially the same as those shown in the figures.

Note the uniformity of air temperature from center of room to within 6 in. of the cold wall. Fixed thermocouples which could be read nearly simultaneously indicated no horizontal gradient at the 60-in. level from the center of the room to within 2 in. of the cold wall. In Fig. 2, with the extremely cold wall, the air at the 6- and 12-in. levels is warmer near the cold wall than in the center of the room; however, at the 2-in. level, the opposite is true. This is probably due to the thin layer of cool air flowing down the wall and across the floor in widening layers. The air-flow pattern will be discussed later.

Journal Section

The results given in Figs. 2, 3, and 4 were obtained with an 8-ft wide heated panel. Tests made with wider and narrower panels indicated that the width of the panel did not appreciably alter the air-temperature distribution in the living space *i.e.*, up to 6½ ft (2.0 m) above the floor.

The floor-to-ceiling air-temperature gradients shown in Figs. 2, 3, and 4 were about the same as those previously reported[8] for a cold-wall condition. A comparison of the air-temperature gradients at a position 1 ft from the cold wall can be made from Fig. 5A for 3 cold-wall temperatures.

The air-temperature gradients shown in Fig. 5A were measured under conditions of a uniform temperature of the cold wall. The question arose as to the effect a non-uniform cold-wall temperature, which

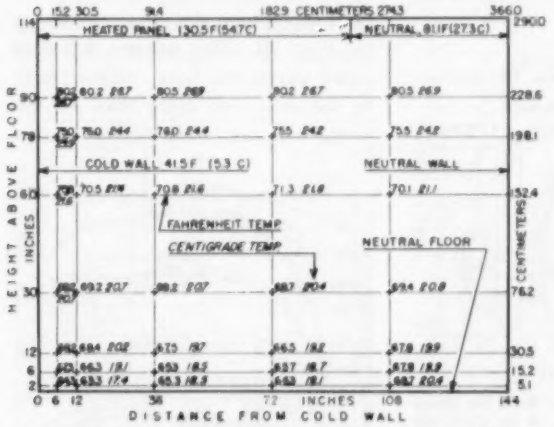

Fig. 3—Room-air temperature distribution, center of room, cold wall 41.5 F (5.3 C), test No. 507

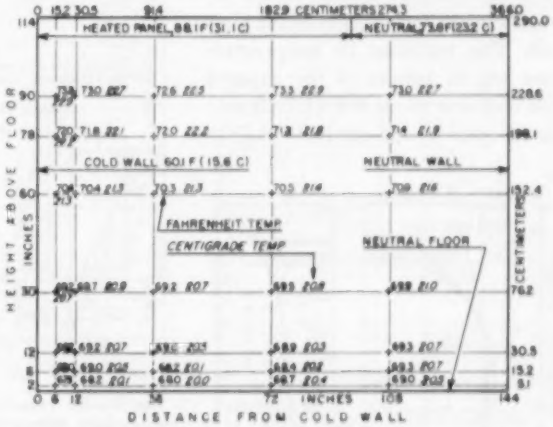

Fig. 4—Room-air temperature distribution, center of room, cold wall 60.1 F (15.6 C), test No. 511

Table 1—Test Conditions

Test No	Cold-Wall Temp.		Ceiling Panel Width		Ceiling Temperature Heated[a]		Ceiling Temperature Unheated[b]		Room-Air Temp. (5 Ft Height, 1.52 m) Observed		Floor[b] Temperature Average		Wall[b] Temperature Average	
	F	C	Ft	Meter	F	C	F	C	F	C	F	C	F	C
505	59.7	15.4	4	1.22	96.4	35.7	72.4	22.5	69.2	20.7	70.2	21.2	70.4	21.3
511	60.1	15.6	8	2.44	88.1	31.1	73.8	23.2	70.1	21.1	71.2	21.8	71.3	21.8
512	60.5	15.8	12	3.66	83.4	28.6	NONE	NONE	70.2	21.2	71.0	21.7	71.6	22.0
513	54.4[c]	12.4	8	2.44	98.4	36.8	74.2	23.4	69.6	20.9	71.0	21.7	71.4	21.9
506	42.1	5.6	4	1.22	171.2	77.3	78.5	25.8	70.1	21.1	75.9	25.3	72.9	22.7
507	41.5	5.3	8	2.44	130.5	54.7	81.1	27.3	70.4	21.3	74.8	25.8	74.4	23.5
508	41.6	5.3	12	3.66	114.6	45.9	NONE	NONE	69.9	21.0	74.2	25.4	75.3	24.1
510	27.3	−2.6	8	2.44	158.3	70.1	87.1	30.6	70.0	21.1	78.3	25.7	77.7	25.4
509	27.0	−2.8	12	3.66	137.5	58.6	NONE	NONE	69.9	21.0	77.7	25.4	77.2	25.1

[a] Panel temperature required to give observed room-air temperature.
[b] Neutral temperature, surface neither heated nor cooled.
[c] Glass temperature avg 55.4 F, with cold surface behind glass at 25 F.
Ventilation air 75 cfm at 70 F for all tests.

is the usual condition, would have upon the air temperature near the wall. The test with the inner glass wall covering one-half of the cold wall furnished the answer. In this test the surface temperature of the uncovered cold wall was adjusted to be the same (within 1 F deg) as the average surface temperature of the glass wall. The variation in temperature from top to bottom of the exposed cold wall was about 3 F (1.7 C) and for the glass wall about 15 F (8.3 C)

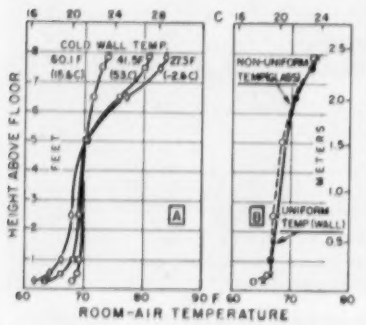

Fig. 5—Room-air temperature gradients, 1 ft (0.3 m) from cold wall, for various cold wall temperatures, 8 ft (2.4 m) panel width

(see section on Surface Temperatures).

Air temperatures 1 ft from the center of the exposed cold wall and the glass wall are shown in Fig. 5B. As may be seen from the figure, very little difference exists between the air temperatures near the uniform temperature wall and the non-uniform temperature wall (glass).

Air Movement

The direction of air motion was determined by observation of cigarette-smoke patterns. In general, the flow of air consisted mainly of a very thin air film in contact with the cold wall which fell rapidly down the wall with increasing velocity and thickness, then flowed across the floor, rising slightly, with part of this air carrying up the opposite wall. The air flow near the ceiling was slight except in the vicinity of the ceiling diffusers which introduced the ventilation air. The bulk of the room air was relatively still. As the air flow down the cold wall was not in the normally occupied space, only the flow across the floor was considered to be important.

The velocity of the air flow across the floor is shown in Fig. 6. The air velocities are the average of the maximum and minimum observations taken over a period of about 15 to 90 sec. The flow of air shown in the

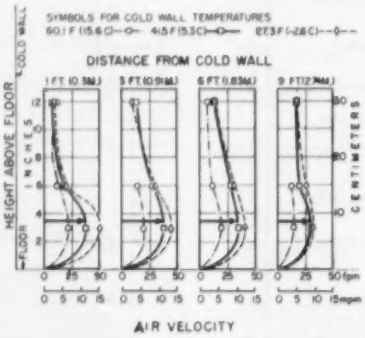

Fig. 6—Air velocity near floor for three cold wall temperatures, 8 ft (2.4 m) panel width

figure is away from the cold wall, decreasing in velocity and increasing in height. The velocity of the air was greater with the lower wall temperatures, but it did not change noticeably with the size of the heated ceiling panels.

The velocity of the air flowing across the floor was also measured without ventilation air being supplied to the room, for the surface-temperature conditions of the test No. 510. The measured air velocities across the floor were about the same, with or without ventilation.

No significant difference in the velocity of air flow across the floor was noted between the uniform cold-wall temperature condition and the non-uniform or glass wall. However, the velocity of the air flowing down the glass partition was slightly less at the top and more at the bottom than for the wall of the same but uniform temperature.

Floor-Surface Temperature

The temperature of the surface of the floor is recognized as contributing to foot comfort for adults and body comfort for children playing on the floor.

Figs. 7A and 7B show the effects of the temperatures of the cold wall and heated panel and of panel width on floor-surface temperatures. In Fig. 7A, the floor temperature is shown to be highest for the highest panel temperature, despite the lower cold-wall temperature. The width or location of the heated ceiling panel influences the temperature of the floor as shown in Fig. 7B. The narrow 4-ft-wide panel warms the floor surface closer to the cold wall more than do the wider 8-ft and 12-ft ceiling panels.

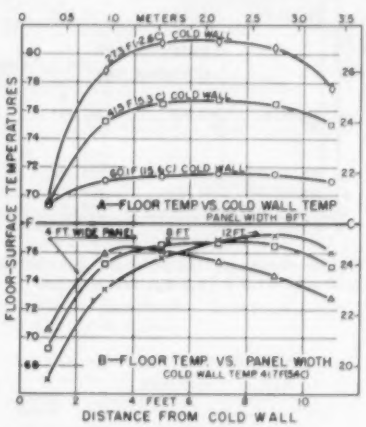

Fig. 7—Floor-surface temperatures

Because the floor surface was neutral and the average floor-surface temperature was higher than the room air, the floor must have received a net gain of radiant energy from the surroundings, which was given up to the room air by convection. The warm floor, therefore, contributed to the uniformity of the room air temperature.

Globe Thermometer Temperatures

The globe thermometers measure the combined effect of air temperature, air movement, and radiation. Where still-air conditions exist and humidity effects are negligible, the globe temperature is sometimes used as an environmental index[9].

Observed globe temperatures taken at the 60- and 30-in. levels at the center of the test room are shown in

Fig. 8. The temperatures at the 12-in. level (not shown) were much more influenced by air movement, but near the cold wall were within one deg F of those shown in Fig. 8 for the 30-in. level. In the center of the room, however, the difference in globe temperatures at the 30- and 12-in. levels ranged up to about 3 F for the lowest temperature cold-wall condition.

In Fig. 8A the globe temperatures are higher for the colder wall conditions. This is the result of the warmer ceiling panels required to maintain

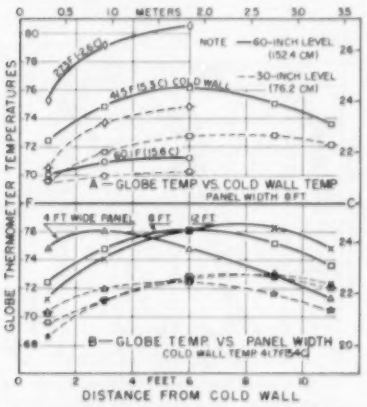

Fig. 8—Globe thermometer temperatures

a 70 F air temperature (see Table 1) and the warmer surface temperature of the neutral three walls and the floor. In most locations the influence of radiation is sufficient to raise the globe temperature above that of the room air.

The effect on the globe temperatures of the size and also location of the heated panel is shown in Fig. 8B. In the vicinity of the cold wall, the smaller, warmer ceiling panel causes the globe temperatures to be higher, whereas near the neutral wall, opposite the cold wall, the influence of the smaller ceiling panels is less and the globe temperatures are lower.

Mean Radiant Temperature

The radiometer measures a temperature which is the equivalent black-body temperature of the surfaces which the radiometer sees. The radiometer surface is flat, and receives radiation from all directions of a hemisphere. The six directional readings previously described were averaged to obtain the mean radiant temperature. The result of a 6 reading survey was judged to be acceptable only after it was found to check satisfactorily with the result of a 26 reading survey. This more extensive survey included the 6 readings taken normal to the 6 room surfaces, together with all 20 additional 45 deg

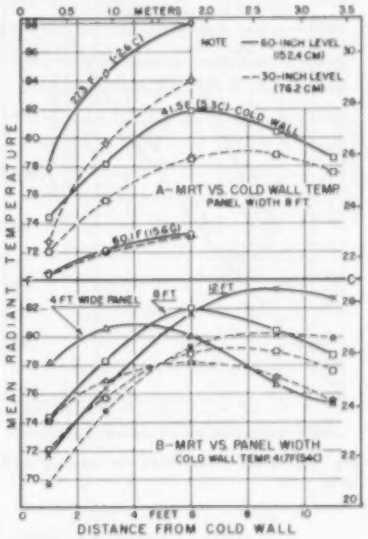

Fig. 9—Mean radiant temperature

angular readings which could be taken about a point.

The mean radiant temperatures are shown in Fig. 9A, as a function of position and cold-wall temperature. The mean radiant temperature is shown to be highest for the coldest wall temperature due to the higher required panel temperature. Similarity is notable between this figure, which shows the radiation effect, and of Fig. 8 (globe temperature), which integrates the radiation and convection. The mean radiant temperatures were higher than the globe temperatures. The mean radiant temperature is considered by many as an important part of a comfort index.

Fig. 9B shows the effect of the width and temperature of the heated part of the ceiling upon the mean radiant temperature. The MRT in both Figs. 9A and 9B are elevated above the 70 F room-air temperature in all of the occupied space. The difference between MRT and room-air temperature would be extreme in an unfurnished room. In a previous study[8] the room-air temperature in a furnished room was found to be higher than in an empty room having the same room-surface temperatures. Thus, room furnishings would tend to reduce the elevation of the MRT above that of the room air.

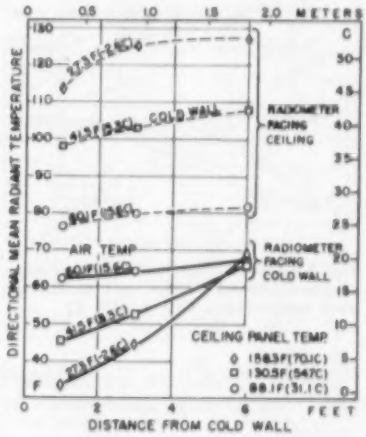

Fig. 10—Directional mean radiant temperature, 60-in. (152.4 cm) level, 8 ft (2.4 m) wide panel

Directional Mean Radiant Temperatures (DMRT)

The human body is in fact a thermal integrater. To what extent the body may integrate warmth on one side and coolness on the other has not been fully investigated. Some excellent work has been done in this direction by F. A. Chrenko[10]. Whether the comfort criteria for radiation should be founded on a mean radiant or some directional radiant temperature[11] will be studied in the Society's long-range program on human comfort. However, the directional radiant temperatures reported in Figs. 10 and 11 are of interest in guiding the comfort investigation. In both figures the directional mean radiant temperatures are those obtained with the radiometer facing in the direction of the cold wall or the ceiling.

In Fig. 10, for the 8-ft-wide panel, the directional mean radiant tem-

perature DMRT facing the cold wall approached the temperature of the cold wall as the distance from it decreased. In the direction of the ceiling, the DMRT was the highest for the test in which the panel temperature was highest and the cold-wall temperature was the lowest (27 F).

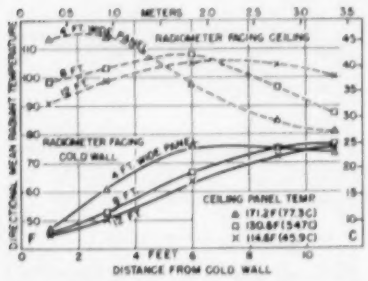

Fig. 11—Directional mean radiant temperature, 60-in. (152.4 cm) level, cold wall temperature 41.7 F (5.4 C)

Obviously, there is an upper limit of panel temperature satisfactory for comfort.

Fig. 11 shows the effect of panel width and temperature on the DMRT for a given cold-wall temperature. It may be noted that the DMRT in the direction of the cold wall increases as the panel width decreases and the panel temperature increases. In the direction of the ceiling, the DMRT near the cold wall also increases as the panel temperature increases, despite a decrease in panel width.

No difference was found in the DMRT as measured 1-ft away from the non-uniform glass partition and 1-ft away from the equivalent isothermal cold wall.

Both the mean radiant temperature and the directional mean radiant temperature could be calculated satisfactorily on the assumption that all surfaces were thermally black. Because of the high emissivity of the surfaces, reflections were quickly damped out. The accuracy of the calculated directional mean radiant temperatures improved, compared with observed, when the areas of the surfaces with non-uniform temperatures were divided into smaller divisions[12].

Heat Flow

The heat loss from the test room must be matched essentially by the heat input to the room from the heated ceiling panel. The heat output of the ceiling panel was measured by 32 plate-type heat-flow meters which cov-

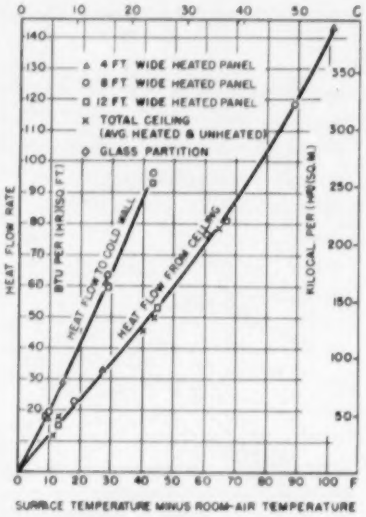
4 FT. WIDE HEATED PANEL
8 FT. WIDE HEATED PANEL
12 FT. WIDE HEATED PANEL
TOTAL CEILING (AVG. HEATED & UNHEATED)
GLASS PARTITION
HEAT FLOW RATE
BTU PER (HR)(SQ FT)
KILOCAL PER (HR)(SQ M)
HEAT FLOW TO COLD WALL
HEAT FLOW FROM CEILING
SURFACE TEMPERATURE MINUS ROOM-AIR TEMPERATURE

Fig. 12—Heat-flow rates for ceiling and cold wall

ered about 10 percent of the ceiling area.

The lower curve of Fig. 12 shows the unit panel output of the heated part of the ceiling *vs* the temperature difference between the ceiling and the room air. The observed heat flow rates are shown to lie on the curve regardless of the width of the heated panel. Included in Fig. 12 are the average heat-flow rates from the entire ceiling, plotted against the difference between the average ceiling temperature and the room-air temperature. These points follow closely the curve drawn for the heated panels only.

A comparison of the ceiling heat-flow curve of Fig. 12 with the ceiling panel outputs reported in the Society's paper on Thermal Design of Warm Water Ceiling Panels[13] shows general compatability of the data in the 2 studies. Therefore, the equations which were used in developing the design procedure may be applied without serious discrepancy to the heated panel in these tests. The basic equations are reported in an earlier paper[14]. The radiation equations are valid, as the surface emissivities (0.92 to 0.93) were nearly the same as those previously reported[14].

The average heat-flow rates through the cold wall are also shown in Fig. 12. Heat flows calculated from the radiation and convection equations reported in reference 14 were found to be in reasonable agreement with the observed values.

Fig. 13 shows the variation of the heat flow through the cold wall with height. Each plotted point was determined by averaging the readings

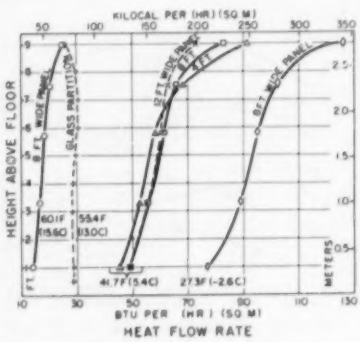

Fig. 13—Heat flow into cold wall

of all of the heat-flow meters on the cold wall located at a given height. The 3 curves illustrating the effect of the temperature of the cold wall (ceiling panel 8-ft wide) show that the heat flow for the colder wall is not only higher, but also the vertical gradient is greater. The 3 central curves, with a constant 41.7 F cold-wall temperature illustrate the effect of panel width and temperature upon the heat-flow gradient. The narrower but warmer 4-ft-wide panel causes greater heat flow through the upper section of the cold wall and less through the lower section than do the wider ceiling panels. Both radiation and convection contribute to the heat flow. However, it is likely that the radiation exchange is largely responsible for the variation of heat-flow gradients with the width and temperature of the heated panel.

The heat flow into the glass partition was measured by commercial-type heat-flow meters, which were pressed against the glass surface at

desired locations. The absolute rates of heat flow obtained by this method were not considered precise. These heat-flow rates were corrected to give the same average rate as measured in the same test and temperature for the isothermal cold wall. The resulting heat-flow rates through the glass are shown in Fig. 13. The convection between the glass in the partition and the air in the space behind the glass is responsible for the relatively uniform heat flow. The effect that convection in the wall space has upon surface temperature and heat flow

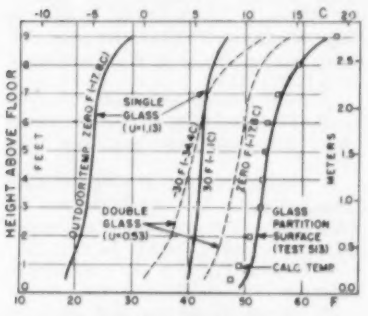

Fig. 14—Calculated surface temperature gradients for exposed wall or window, room air 70 F (21.1 C)

through the wall has been investigated thoroughly for an air-heating system[15,16].

Surface Temperatures

The surface of an actual exposed wall or window is not uniform in temperature, and since in these tests the heat is supplied at the ceiling, it is particularly desirable to know what surface-temperature gradients would exist for an actual wall under the test-room conditions. Calculation of these temperatures was attempted by the method described in the Appendix.‡ The main purpose of the test with the glass partition was to obtain a non-uniform surface temperature against which the calculated surface temperatures could be compared. These are given at the right-hand side of Fig. 14. The calculated temperatures are greater above the 8-ft level and less below 2 ft than are the observed. On the basis of temperature difference, the convection transfer to a non-uniform temperature cold wall would be less near the top and more near the bottom of the wall than for an isothermal wall. This may be the reason for the difference between calculated and observed glass-surface temperatures, because the thermal conductances used in the calculation were obtained from isothermal wall conditions.

The calculated surface-temperature gradients shown by the other curves of Fig. 14 may also be slightly greater than the true gradients and should be weighed accordingly. (See appendix for calculations). A double-glass window is shown in Fig. 14 to have about the same average inside surface temperature with −30 F (−34.5 C) outdoors as has single-glass at +30 F (−1.1 C) outdoors. The temperature gradient for the double-glass, nevertheless, is much greater. As pointed out previously this gradient may be slightly greater than the true gradient.

The average surface temperatures of single and double glass and a wall having a U-value of 0.17 Btu per (hr) (sq ft) (F deg) were calculated by the method described previously, and are given in Fig. 15 for various outdoor temperatures. For comparison the surface temperature is given for single glass $U = 1.13$ or 5.52 kilocal per (hr) (sq m) (C deg) with a fixed inside coefficient, surface to air, of 1.50 or 7.33 kilocal per (hr) (sq m) (C deg). This U-value is reported in Table 20 of THE GUIDE, 1955, for a single sheet of glass in a vertical position. The inside film coefficient, 1.5, is an average value for vertical glass and glass block calculated on the assumption that the room-air temperature equals the average temperature of the room surfaces seen by the glass. This condition does not necessarily prevail in an actual room, and the curve based on a film coefficient of 1.5 cannot be considered representative for any type or arrangement of heating system.

The inside coefficient for test conditions may be obtained from Fig. 12

by dividing the cold-wall heat-flow rate by the temperature difference between room air and the cold wall. This averages about 2 Btu per (hr) (sq ft) (F deg) or 9.76 kilocal per (hr) (sq m) (C deg) for a temperature difference of 10 to 15 F (5 to 8 C). As pointed out previously, furniture in a room tends to increase the room-air temperature and the inside

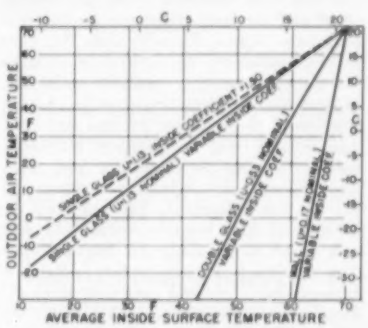

Fig. 15—Average inside surface temperature of exposed wall or all glass wall as calculated for room heated by ceiling panel, room air 70 F (21.1 C)

film coefficient may be somewhat lower in an actual room. Previous data also indicated that the heat flow through a cold wall, and therefore the film coefficient, may increase slightly with increase in cold-wall height.

Conclusions

On the basis of tests conducted in a room with one cold wall and heated by ceiling panels adjacent to the cold wall, the following conclusions were drawn:

1. Variations in room-air temperatures were small in the living space to within inches of the cold wall, in any horizontal plane above approximately the 6- to 12-in. level (15.2 to 30.5 cm). Below this level the air temperature was influenced by air flowing down the cold wall.

2. The vertical gradients of room-air temperature were minimum when the cold wall and heated panel were nearest 70 F. The vertical temperature gradients between the 2-in. and 60-in. levels in the room increased to only 5.6 F deg (3.1 C deg) at the extreme condition when the cold wall was 27.3 F (−2.6 C) and the 8-ft wide ceiling panel was at 159.4 F (70.8 C). Under the usual practical conditions it would be expected that the gradients would be less.

‡It is planned to publish the Appendix with this paper in the TRANSACTIONS. Mimeographed copies of the Appendix may be obtained upon request from ASHAE Research Laboratory, 7218 Euclid Ave., Cleveland, Ohio.

3. Air flowing down the cold wall travels across the floor in a layer about 12 in. or less in thickness. Average velocities measured within this layer were up to 40 fpm (12.2 mpm) with a 40 F (4.4 C) cold wall, and 50 fpm (15.2 mpm) with a 27 F (−2.8 C) cold wall.

4. The floor surface, which did not lose or gain heat from below, was warmed to average temperatures exceeding the room-air temperature, so that the floor contributed convective heat to the room air as well as reradiated heat to cooler wall surfaces.

5. The heat emission from the ceiling panel and the heat absorption by the cold wall vary almost linearly with the temperature difference between these surfaces and the room air. The combined coefficient of heat transfer from heated ceiling panels was found to be about 1.2 Btu per (hr) (sq ft) (F deg temperature difference between ceiling panel surface and room air). Metric: 5.9 kilocal per (hr) (sq m) (C deg difference). The combined coefficient of heat transfer to the cold wall was found to be about 2.0 Btu per (hr) (sq ft) (deg F temperature difference between room air and cold-wall surface). Metric: 9.8 kilocal per (hr) (sq m) (C deg difference).

6. Globe-thermometer temperatures, at 30- and 60-in. levels (76.2 — 152.4 cm), 1 ft away from the cold wall, varied from about 1 ½ F deg (0.8 C deg) below room-air temperatures to 5 ½ F deg (3.1 C deg) above room-air temperature.

7. Mean radiant temperature at the 30- and 60-in. levels (76.2 — 152.4 cm) are in general higher than the room-air temperature, the elevation of the mean radiant temperature being greater for the colder wall conditions, because of the higher panel temperatures.

8. The directional mean radiant temperature measured at the 60-in. level when facing the ceiling was a value between the room-air temperature and the ceiling panel temperature, varying with the distance from the cold wall. Likewise, at the same level, the directional mean radiant temperature measured when facing the cold wall was a value between the air and wall temperatures, decreasing with the distance from the cold wall. Directional radiation measurements may be of considerable importance in future comfort studies.

9. Within the range tested and for the same total heat output, reducing the width and increasing the temperature of the heated ceiling panel adjacent to the cold wall did not appreciably alter the distribution of room-air temperatures in the occupied zone of the room. The narrower, warmer panels increased the globe thermometer temperatures, the mean radiant temperatures, and the DMRT near the cold wall.

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11. Necessity of Using a Directional Mean Radiant Temperature to Describe the Thermal Conditions in Rooms, by Vagn Korsgaard (ASHVE Journal Section, *Heating, Piping & Air Conditioning*, June 1949, p. 117).

12. *Panel Heating and Cooling Analysis*, by B. F. Raber and F. W. Hutchinson (John Wiley and Sons, Inc., New York, 1947).

13. Thermal Design of Warm Water Ceiling Panels, by a Subcommittee of TAC on Panel Heating and Cooling and Laboratory Staff (ASHAE Journal Section, *Heating, Piping & Air Conditioning*, December 1955, p. 123).

14. Natural Convection and Radiation in a Panel-Heated Room, by T. C. Min, L. F. Schutrum, G. V. Parmelee and J. D. Vouris (ASHAE Journal Section, *Heating, Piping & Air Conditioning*, May 1956, p. 153).

15. ASHVE Research Report No. 1446 — Thermal Performance of Frame Walls, by G. O. Handegord and N. B. Hutcheon (ASHVE Transactions, Vol. 58, 1952, p. 171).

16. ASHVE Research Report No. 1487 — Thermal Performance of Frame Walls — Part II — Air Spaces Blocked at Mid-Height, by G. O. Handegord and N. B. Hutcheon (ASHVE Transactions, Vol. 59, 1953, p. 449).

PAST PRESIDENTS TRAVEL ABROAD

Two past presidents of the Society have spent considerable time in foreign countries during the course of the last few months.

Past Pres. A. J. Offner, Beechhurst, L. I., N.Y., together with Mrs. Offner left in the Spring on an extensive tour, and among the places they visited were the Holy Land, Turkey, Greece, Italy, Switzerland, Austria and England. They returned in midsummer.

Also on an extended trip was Past Pres. L. N. Hunter, Johnstown, Pa. His itinerary took him to England, Sweden, Denmark, West Germany, Holland, Switzerland, France and South Ireland. Mr. Hunter left in May and returned during the latter part of June.

John R. Allen Memorial Library

The ASHAE Committee on Research gratefully acknowledges the following gift to the John R. Allen Memorial Library, which is maintained at the Society's Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio.

Fan Engineering, edited by R. D. Madison. Gift of Buffalo Forge Co. and the editor.

Kalender fur Heizungs-, Luftungs- und Badetechniker, 1955 (Calendar for Heating, Air-Conditioning and Bath House Technicians) (Laundries). Gift of K. K. Paldrock, 2821-A-Buchanan St., San Francisco 23, Calif.

The presentation of textbooks and pamphlets in the field of heating, ventilating and air conditioning and allied fields, by authors and others, will be welcomed by this library. Suitable book plates carry the name of the donor and date of the gift.

Semi-Annual Meeting Is Washington Big Event

Seven session meeting on June 18, 19 and 20 draws one of largest registrations ever for a summer meeting of Society

With a total attendance of 646, the 1956 Semi-Annual Meeting took place at The Shoreham and Sheraton-Park Hotels in Washington, D.C. It was the first meeting of the Society in the national capital since 1940 and many took advantage of the situation to renew acquaintance with the surrounding attractions of Washington, both old and new. Members and guests came from 33 states as well as from Canada, England, India and Sweden. Attendance figures indicate that 349 members, 82 guests, 161 ladies, and 54 children were registered.

The program was most intensive with events scheduled for practically all available hours from the opening session on June 18 until the end of the banquet late on Wednesday evening, June 20. There were 7 sessions during the 3 days, making concurrent meetings necessary at all times except during the first session on Monday. A total of 14 technical papers was presented and discussed, while 2 sessions were of the symposium type. All attracted large attendance.

So intensive a program and one so well carried out calls for careful planning and much attention to details on the part of the entire host chapter and especially on the part of the members of the committee in charge. The Washington, D.C., Chapter called on P. R. Achenbach to head its Committee on Arrangements as general chairman. He was ably assisted by W. C. Reamy, vice chairman, and W. A. Danielson, honorary chairman.

Much of the detailed work was the result of the efforts of the following committee chairmen: *Banquet* — F. A. Leser; *Children* — J. W. Morgan; *Entertainment* — J. H. Broome; *Finance* — A. S. Gates, Jr.; *Ladies* — Mrs. J. H. Broome; *Publicity* — B. P. Evans; *Reception* — J. G. Muirheid; *Sessions* — G. C. F. Asker; *Sports* — F. E. McArdle; *Transportation* — S. R. Allen.

First Session, Monday, June 18, 9:30 a.m.

Pres. John W. James, Chicago, Ill., immediately after opening the meeting and presenting the Society Officers, asked Chairman Achenbach to outline the meeting program and he responded by also extending a welcome on behalf of the Washington Chapter.

Following this, President James announced that the Committee on Resolutions would consist of G. A. Linskie, Dallas, Tex., as chairman; D. Lorne Lindsay, Montreal, Canada; and H. G. Gragg, Chicago, Ill.

President James then announced that 2 technical papers were scheduled for presentation at this session. He read the rules for technical sessions and first called on L. L. Hill, Minneapolis, Minn., who presented the paper, Comparative Performance of Indirect Water Heaters, by L. L. Hill and W. S. Harris (published in ASHAE Journal Section, *Heating, Piping & Air Conditioning*, February 1956, p. 141).

Following discussion of this paper, President James introduced T. C. Min, Cleveland, Ohio, of the Research Laboratory staff, who presented the paper, Natural Convection and Radiation in a Panel-Heated Room, by T. C. Min, L. F. Schutrum, G. V. Parmelee and John Vouris (published in ASHAE Journal Section, *Heating, Piping & Air Conditioning*, May 1956, p. 153).

After this discussion, President James adjourned the session at 11:10 a.m.

Second Session, Tuesday, June 19, 9:30 a.m.

First Vice Pres. P. B. Gordon, New York, N. Y., opened the second session in the Main Ballroom of the

Shoreham Hotel and announced that L. G. Miller, East Lansing, Mich., scheduled to act as vice chairman during the presentation of the technical papers, had found it impossible to be at the session.

The first paper, Heat Requirements of Snow Melting Systems, by W. P. Chapman and Samuel Katunich (published in ASHAE Journal Section, *Heating, Piping & Air Conditioning*, February 1956, p. 149) was presented by W. P. Chapman, Pittsburgh, Pa.

The second paper, Small-Pipe Perimeter Heating in a Residence, by D. R. Bahnfleth, H. T. Gilkey and C. F. Chen (published in ASHAE Journal Section, *Heating, Piping & Air Conditioning*, May 1956, p. 135) was presented by D. R. Bahnfleth, Urbana, Ill.

Vice President Gordon then presented W. R. Brisken, Bloomfield, N. J., who read his paper, Heat Load Calculations by Thermal Response, by W. R. Brisken and S. G. Reque (published in ASHAE Journal Section, *Heating, Piping & Air Conditioning*, July 1956, p. 143).

After the completion of the discussions which followed the reading of each of these technical papers, Vice President Gordon adjourned the session at 12:20 p.m.

Third Session, Tuesday, June 19, 9:30 a.m.

Immediately after calling the meeting to order in the West Ballroom at the Shoreham Hotel, Second Vice Pres. E. R. Queer, University Park, Pa., announced that R. S. Dill, Washington, D. C., would act as vice chairman during the presentation of the 3 technical papers for this session.

After Vice Chairman Dill had read the rules for technical sessions, he

introduced J. B. Austin, Jr., Cleveland, Ohio, who read the paper, Air Velocities in Two Parallel Ventilating Jets, by Alfred Koestel and J. B. Austin, Jr. (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, February 1956, p. 137).

In the absence of S. C. Chang, the paper, Dependence of Water Vapor Permeability on Temperature and Humidity, by S. C. Chang and N. B. Hutcheon (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, March 1956, p. 149) was presented by N. B. Hutcheon, Ottawa, Ont., Canada.

As the concluding paper at the session, F. A. Joy, University Park, Pa., read the paper, Effect of Unbalanced Air Pressure on Permeance, by F. A. Joy and D. R. Fairbanks (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, June 1956, p. 123).

In accordance with the usual practice, Vice Chairman Dill called for discussion of each of these papers following its presentation. On the completion of the discussion period, Mr. Dill turned the gavel back to Vice President Queer who adjourned the session at 11:40 a.m.

Fourth Session, Wednesday, June 20, 9:30 a.m.

President James presided in the Main Ballroom of the Shoreham Hotel and at once introduced W. F. Friend, New York, N. Y., who presided as vice chairman during the presentation of the 3 technical papers.

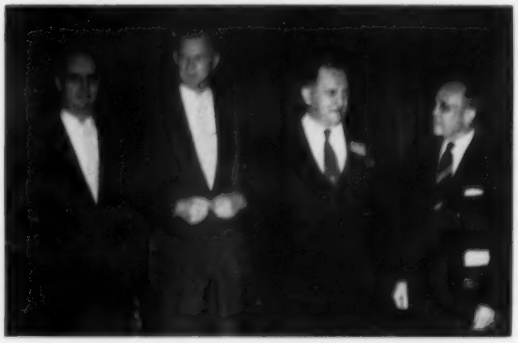
The first of these papers, Laboratory for Solar Energy Study at Minnesota, by R. C. Jordan and J. L. Threlkeld (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May 1956, p. 143) was given by R. C. Jordan, Minneapolis, Minn.

The second paper on the program was presented by its author, G. S. Smith, Seattle, Wash., and is entitled Intermittent Ground Grids for Heat Pumps, by G. S. Smith (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, June 1956, p. 127).

Prof. Merl Baker, Lexington, Ky., then presented the paper, Intermittent Heating and Cooling of Buildings, by P. L. Pfennigwerth and Merl Baker (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, June 1956, p. 113).

Following the discussion period, Vice Chairman Friend announced that President James would again take charge of the session which he adjourned at 11:40 a.m.

Shown at Semi-Annual Meeting (l. to r.) W. C. Reamy, G. R. Walz, S. R. Allen, R. S. Dill, all from Washington, D.C., area, and W. A. Grant, Syracuse, N.Y.



(l. to r.) R. C. Jordan, Minneapolis, Minn.; G. B. Supple, Indianapolis, Ind.; R. S. Dill, Washington, D.C.; and M. K. Fahnestock, Urbana, Ill.

Fifth Session (Symposium), Wednesday, June 20, 9:30 a.m.

This session which was organized in symposium form was called to order by First Vice Pres. P. B. Gordon in the West Ballroom at the Shoreham Hotel, who at once introduced T. H. Urdahl, Washington, D. C.

The theme of the symposium was the position that a national Society should take in the problem of Standards and Codes as related to its particular activities.

C. H. Pesterfield, East Lansing, Mich., the moderator, had arranged for speakers to be present and state their views on 6 topical subdivisions of this general theme as follows: *Standards and Codes in General* — J. C. Fitts, consultant, *Heating, Piping & Air Conditioning Contractors National Association*, New York, N. Y.; *Protective Standards* — Cyril Ainsworth, technical director, *American Standards Association, Inc.*, New York, N. Y.; *Governmental Aspects* — R. S. Dill, chief of Heating & Air Conditioning Section, National Bureau of Standards, Washington, D.C.; *Local and Municipal Standards and Codes* — John W. James, president ASHAE, Chicago, Ill.; *Commercial-Industrial Standards* — G. S. Jones, managing director, *Air-Conditioning and Refrigeration Institute*, Washington, D.C.; *Establishment of Standards and Codes through Experimentation* — L. N. Hunter, vice president of engineering and research, National-U. S. Radiator Corp., Johnstown, Pa. In the absence of Mr. Hunter, his prepared material was presented by M. W. McRae, directing engineer,

Heating Engineering Dept., Crane Co., Chicago, Ill.

Professor Pesterfield, acting as moderator for the Symposium, then called on each of these speakers. Following completion of the formally prepared papers, the session was open for questions and comments from the floor.

North Jersey Chapter members in attendance (l. to r.) M. C. Christesen, C. H. Smith, W. C. Kruse, Jr., J. P. Soule and H. S. Wheller, Jr.

(l. to r.) C. F. Gilbo, Lancaster, Pa.; N. B. Hutcheon, Ottawa, Ont.; F. F. Ross, London; and A. Grant Wilson, Ottawa

That those present had found the subject matter of interest was shown by the discussions which were at once brought forth. Among those who took part in the discussions and questions were William Bohn, New York, N. Y.; H. B. Nottage, Encino, Calif.; R. K. Thulman, Washington, D.C.; John W James, Chicago, Ill.; A. B. Newton, Wichita, Kan.; W. L. Fleisher, New York, N. Y.; L. E. Seeley, Durham, N. H.; Lester T. Avery, Cleveland, Ohio; K. O. Schlentner, Johnstown, Pa.; M. G. Munce, York, Pa.; Alfred Best, Washington, D.C.; C. H. Randolph, Milwaukee, Wis.; and F. H. Faust, Bloomfield, N. J.

Abstracts from the remarks of the speakers at this Symposium session can be found on pages 138 to 143 of this issue of the JOURNAL. There is also information concerning plans for making available a substantially full record of the proceedings at the session, including both the speakers' papers and the discussions.

Following the close of the question period, Vice Chairman Urdahl turned the meeting back to First Vice President Gordon who adjourned the session at 12:05 p.m.

Sixth Session (Symposium), Wednesday, June 20, 2:00 p.m.

Meeting in the Main Ballroom at the Shoreham Hotel, the sixth session was called to order by Second Vice Pres. E. R. Queer. He announced that W. A. Grant, Syracuse, N. Y., would take charge of the session as vice chairman. Mr. Grant then outlined the nature of the session which had been organized in the form of a symposium covering the general subject of Residential Air Conditioning. Since L. H. Haeger, Levittown, Pa., had found it impossible to attend the session, Mr. Grant acted as moderator in his place. Five topical papers on this general subject had been prepared as follows: *Combination Fuel Operated Systems* — W. E. Hood, acting director of engineering, Carrier Corp., Syracuse, N. Y.; *Fuel Operated All-Year Systems* — A. B. Newton, chief design engineer, The Coleman Co., Wichita, Kan.; *Electrically Operated Systems* — E. R. Ambrose, air conditioning engineer, American Gas & Electric Service Corp., New York, N. Y.; *Future System Developments* — W. F. Friend, mechanical engineer, Ebasco Services, Inc., New York, N. Y.; *Performance of Systems* — W. H. Scott, sales engineer, Residential Air Conditioning, Minneapolis-Honeywell Regulator Co., Cleveland, Ohio.

Each of these speakers was introduced in turn by Moderator Grant and each read his prepared paper. Following completion of the papers Mr. Grant then indicated that the session would be concluded by affording those present an opportunity to express their views concerning the general subject or to ask questions concerning the speakers' remarks.

Among those who took part in the discussion period which followed were: R. C. Edwards, Pompton Plains, N. J.; S. S. Sanford, Detroit, Mich.; S. F. Gilman, Syracuse, N. Y.; P. E. McNall, Jr., Hopkins, Minn.; R. L. Boyd, Rochester, N. Y.; Richard Hellman, Washington, D.C.; C. S. Wyckoff, Toledo, Ohio; and John E. Haines, Minneapolis, Minn.

It is expected that much of the material presented at the Symposium session will be published in a future issue of the JOURNAL, and also that a substantially complete record of the proceedings, including both the speakers' papers and the discussions will eventually be prepared in bulletin form.

Following completion of the discussion period, Pres. John W. James took charge of the session and called on G. A. Linskie who presented the Report of the Resolutions Committee.

Following the adoption of this Report and there being no further business to come before the session, President James declared the meeting adjourned at 4:45 p.m.

Journal Section

Seventh Session, Wednesday, June 20, 2:00 p.m.

Pres. John W. James presided over the seventh session in the West Ballroom at the Shoreham Hotel and announced that First Vice President Gordon would act as vice chairman during the presentation of the 3 technical papers for the session.

After reading the rules covering technical sessions, Mr. Gordon called on D. G. Shepherd, Ithaca, N. Y., for his paper, Performance of One-Row Tube Coils with Thin-Plate Fins, Low Velocity Forced Convection (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, April 1956, p. 137).

The next paper, Temperature and Humidity Effect on Odor Perception, by W. F. Kerka and C. M. Humphreys (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, April 1956, p. 129) was presented by W. F. Kerka, Cleveland, of the Laboratory staff.

The concluding paper, The Indirect Evaporative Air Cooler, by J. R. Watt and R. A. Bacon (published in ASHAE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May 1956, p. 149) was read by J. R. Watt, Austin, Tex.

View of Children's Banquet, at which they had their own invocation, special menu, and entertainment, with head table visible in background

Following the completion of the discussion period, Mr. Gordon adjourned the session at 5:10 p.m.

Social and Recreational

As soon as the members began to arrive on Sunday before the Meeting officially started, they found that the Hospitality Room of the Washington Chapter was in full operation. This thoughtful arrangement of the Washing Chapter dispensed coffee and punch to all comers throughout the course of the Meeting.

On Sunday night, many took advantage of the opportunity to see the courtesy 20th Century Fox film, *Call Me Madam*, starring Ethel Merman.

ASHAE 1956 Semi-Annual Golf Tournament

PLAYER	GROSS	HDCP.	NET	PLAYER	GROSS	HDCP.	NET
G. Hume	76	7	69	J. B. Hewett	92	22	70
F. E. McArdle	80	12	68	W. F. Peters, III	116	27	89
R. Truxhorn	83	8	75	W. L. Osborn	96	18	78
M. R. Colbert	99	19	80	C. E. Price	87	11	76
R. F. Fisher	102	25	77	C. A. Gustafson	96	25	71
E. F. O'Connell	110	27	83	A. J. Keating	100	27	73
T. F. Burke	87	14	73	C. W. Proctor	80	6	74
H. E. Grossman	102	18	84	A. H. Koch	89	12	77
R. C. McMann	91	15	76	M. F. Blankin	100	19	81
P. H. Norair	101	20	81	E. K. Wagner	92	25	79
F. H. Weller	81	10	71	W. C. Kruse, Jr.	108	25	83
D. Fitzgibbons	105	20	85	H. S. Wheller	121	27	94
W. J. Liebrecht	92	16	76	C. H. Smith	86	12	74
L. Kendrick	99			H. S. Wheller, Jr.	108	25	83
A. J. Riedinger	104			F. J. Swaney	94	22	72
C. Sundell	90	15	75	M. S. Smith		No Card	
C. W. Holliday	92	16	76	W. G. Martin, Jr.	83	10	73
H. J. Noles	110	24	86	W. J. McAdam	92	13	79
R. W. Nelson	83	7	76	J. E. Bladh	87	8	79
J. W. May	87	14	73	T. L. Smith	90	17	73
Arthur Nutting	76	2	74	H. I. Schmidt	85	11	74
J. J. Willis	116	22	94	C. F. Sines	85	10	75
I. W. Clark	114	27	87	B. M. Kluge	104	27	77
D. A. MacWatt	80	9	71	L. T. Avery	105		

Head Table at 1956

***(l. to r.)* Gen. W. A. Danielson, Mrs. P. R. Achenbach, C. M. Ashley, Mrs. V. L. Strompke, A. V. Hutchinson, Mrs. R. S. Dill, Chapter Pres. J. H. Broome, Mrs. John W. James, Hon. A. S. Flemming, Speaker, and Toastmaster R. S. Dill**

A capacity crowd was on hand to hear Gen. Thomas A. Lane, engineer commissioner, District of Columbia, when he spoke at the Welcome Luncheon on Monday noon.

The Golf Tournament on Monday afternoon got under way in a drizzle but this did not deter 48 golfers from entering the Tournament at the Congressional Country Club. As a result of the afternoon play, The Eichberg Memorial Trophy came into the possession of the Washington Chapter when F. E. McArdle, T. F. Burke and F. H. Weller posted a three-man low net score of 212. In the course of this event, F. E. McArdle also posted a low net score for the day of 68 and thus won the ASHAE Past Presidents Research Bowl. The Paul Bunyan Cup came into the possession of H. S. Wheller, Linden, N. J., when he reported the high gross score of the Tournament.

The Get-Together Party on Monday evening also drew a capacity audience in the Blue Room at the Shoreham. There were Inspection Trips on Monday afternoon to the David Taylor Model Basin and on Tuesday afternoon to the Ordnance Laboratory and the National Institute of Health, all of which drew large crowds. An especially enjoyable feature was the Sightseeing Trip to Mt. Vernon on Tuesday afternoon, in which many ladies and children took part.

Special events of interest to ladies included sightseeing trips to the Federal Bureau of Investigation and to the Islamic Center, while a Luncheon and Fashion Show at the Sheraton-Park Hotel on Wednesday was also arranged for their enjoyment.

Mrs. John W. James and the Begum Ali, wife of the Pakistan ambassador, with Kathy James and Nancy Cross in background, taken during visit to Pakistan Embassy, Washington, D.C., June 18

Semi-Annual Banquet

The Semi-Annual Banquet on Wednesday evening was presided over by R. S. Dill, Washington, D. C., as toastmaster. He presented the special guests of the Society and asked Pres. John W. James to present the Past President's Memory Book to John E. Haines, Minneapolis, Minn. As usual at the Banquet also, the Golf Tournament Trophies were presented with suitable exercises. The speaker of the evening, the Hon. Arthur S. Flemming, director, Office of Defense Mobilization, used as his subject, *Defense Through Deterrents*. Also at the Banquet, the Honorary Membership Certificates were presented in absentia to Herbert C. Hoover, New York, N. Y.; Charles F. Kettering, Dayton, Ohio; and Milton S. Eisenhower, University Park, Pa. The Banquet ended with dancing in the Ballroom.

A most unusual feature of the social program was the provision of a Children's Room in the Hotel where there were games and special arrangements for the children throughout the Meeting. This series of events ended with a Children's Party and Banquet on Wednesday night.

(l. to r.) Pres. John W. James, Mrs. P. B. Gordon, 2nd Vice Pres. E. R. Queer, Mrs. J. E. Haines, 1st Vice Pres. P. B. Gordon, Mrs. Queer, Past Pres. Haines, Mrs. W. A. Danielson, Rev. V. L. Strempke, Mrs. J. H. Broome, Gen. Chairman P. R. Achenbach

Standards and Codes Symposium

The Theme

Although the fifth session at the 62nd Semi-Annual Meeting of the Society at Washington was programmed under the above title, its real theme requires a somewhat longer statement. Actually the full theme for the session was:

The Position That a National Society Should Take in the Problems of Standards and Codes as Related to Its Particular Activities.

From this statement it will be seen that the remarks of the several speakers, and the questions and discussions which these remarks brought forth, were all aimed at clarifying the position of the Society toward its present activities and its future policy in connection with this important matter of codes and standards.

The Report

What is included here is a condensation of the prepared papers of the several speakers at the session, and is not a verbatim record of what took place, or an exact statement of the remarks of the speakers. A more complete presentation is in process.

C. H. Pesterfield
Moderator
Professor of
Mechanical Engineering
Michigan State
University

I — Standards and Codes in General

Members of the Society have a vital interest in standards and codes and in the program which establishes them. This paper is offered to establish the broad background of the standards program, as it has developed in American industry, as a foundation for more detailed consideration of the problem throughout the panel discussion.

To establish the interest of the members of this Society it is sufficient to point out that standards make the work of the engineer easier, especially in designing, in specification writing and in the interpretation of plans and specifications. Standards protect the engineer's client and make supervision less costly. Standards protect the public health and safety and the public pocketbook.

J. C. FITTS—Consultant since 1953, *Heating, Piping and Air Conditioning Contractors National Association*. Graduate Princeton University, 1912, B.A. degree. Joined staff of National Association, 1919, as editorial assistant and secretary of Committee on Standardization. Secretary, National Association from 1950 to 1955. For many years intimately connected with the industries standardization program. In 1955, chairman ASHAE Standards Committee.

Broad Field of Standardization

The field of standardization is broad. It extends from dimensional standards to safety standards; from quality standards to standard methods of testing for operational efficiency; from standard symbols and abbreviations to standards of illumination and ventilation.

American industry has forged ahead because the American engineer has realized the vast importance of standardization. The operation of the assembly line, as a method of production, is based upon the interchangeability of parts, even from diverse sources of supply. This interchangeability succeeds because of close control of production to dimensional standards.

Consider an example. In heating and air conditioning, the engineer is concerned with piping systems. The basic standard is the *ASA*-B16 *Standard for Flanges and Flanged and Screwed Fittings*. This is an accepted American Standard for working pressures up to 3000 lb. It started many years ago as a standard for cast-iron fittings for 125- and 250-lb working pressure and has developed through the years, keeping pace with the demands and development of the industry.

The standard pipe thread and the fittings standard make for easy interchange of fittings in our field or in any other field where piping is used. A 2-in. ell will make up in place of another 2-in. ell regardless of the source.

The field of safety offers another example in which we are vitally concerned with manufacturing standards. The heating engineer would find his resources strained if he were forced to determine the safety of every boiler used. Fortunately he can depend upon the manufacturer to conform to the *ASME* codes governing the construction of heating boilers and of power boilers. Also, in this field of safety, the fire prevention codes are of real interest, especially as they govern the design of flues and ducts, the placing of equipment and other items affecting design.

The engineer must always be interested in the performance of the apparatus he is specifying. Unless he wishes to depend upon expensive testing under his own supervision he must accept manufacturers' guarantees. These, in themselves, will be useless unless they are based on performance data obtained under standard testing methods.

A part of the engineer's language is the system of symbols and abbreviations used on drawings. They are a convenient shorthand saving valuable time on the drafting board. Here standardization again serves and the accepted *ASA* Standard for Drafting Room Symbols and Abbreviations saves the designer time, which is money, and eases his supervision problems.

Members of this society have a vital interest in this broad field of standards which will be emphasized throughout this discussion. It is a large subject to cover in one session. The time will be well spent, however, if this panel leads to a realization of the value of standards to every member and to the development of a wider program of Society participation.

The Function of Standards

The primary function of standards is to create savings. A secondary function, of very real importance, is to protect the customer.

The saving to industry through the liberal use of standards is an incalculable amount, both in time and energy, which is only another way of saving money.

For instance, in ordering material *ASTM* specifications save the person ordering from writing long descriptions of what is needed. A few numbers and letters will replace a paragraph. Everyone here knows what an E6010 welding rod is. Try writing a description in metallurgical terms and see how much these 5 symbols, a letter and 4 numbers save.

The secondary function is to give the customer protection — to provide a scale

of values against which he can assess his purchases — standards of size, of quality, of performance the goods must meet.

The old rule of the market place, caveat emptor (let the purchaser beware), has become obsolete under the modern practice of selling goods which conform to recognized standards. This secondary function of standardization has brought order into the market place and made possible transactions of a volume unthought of in previous years. It has been a contributing factor in the steady growth of business.

A third function of standardization has a more altruistic aim — the guarding of public health and welfare. This group of standards also has a sound basis in economics but the humanitarian purpose far outweighs the dollar value. In this group are the safety standards, the fire prevention codes, illumination standards, building codes, all designed to protect the public.

When considering a single standard its function may be purely commercial or industrial or public welfare or it may overlap into the other fields. Whatever its title, a little study will disclose the category and show that it has a distinct function either of serving industry, of protecting the customer or of guarding the public.

Means of Arriving at Acceptable Standards

There are two methods of arriving at acceptable standards: —

1. Enactment of the standard as a law.
2. Formation of the standard through voluntary action of those interested.

Both methods have advantages and disadvantages. Enactment into law has the advantage of placing behind the standard the enforcement machinery of the law. It has the disadvantage of lack of flexibility, and inability to move easily with scientific advances, to change with the times.

The voluntary method has the advantage of flexibility but lacks any means of enforcement to meet the situations created by the lone wolf who places his own profit above public welfare.

This means that the value of flexibility and of enforcement must be weighed in considering whether to seek enactment of standards or voluntary production of standards without rigid enforcement.

In safety standards, devised to protect the public health and welfare, enactment with enforcement seems preferable.

In industrial standards the flexibility of a voluntary program seems more desirable.

In either case, the method of arriving at acceptable standards is important.

Standardization in the United States has developed to such an extent that a definite method of arriving at standards and avoiding conflicts is necessary and there are several established procedures.

One is the method of the *American Standards Association*, known throughout industry as *ASA*. It is a well defined method of arriving at voluntary standards, and one which has proven acceptable to industry and to the public and which is now widely used.

Another method of arriving at voluntary standards is through the Commercial Standards program of the U. S. Department of Commerce. Here under the guidance of the Department an industry committee is formed and the standard created; is circularized to all known to be interested, seeking from them a certificate of acceptance. When acceptances have been received, the standard is published with a list of those who have accepted it.

For standards which affect a single industry or only the members of a single association, the standards are often the work of a Standards Committee of the industry or the trade association interested. This is the simplest and easiest way of establishing a standard, but if wide acceptance is essential it will not bring the results that can be obtained from the program of the *American Standards Association* or the Department of Commerce.

Frequently, however, standards begin in just this way — with a single group who sees the need and develops something to meet that need. Later the desire for wider acceptance leads to the submission of the standard for processing under the other programs.

The Society's Functions

Naturally at a meeting of our Society all this discussion of standardization will raise the question: What are the Society's Functions in Relation to Standards?

Stated in most general terms, they are to represent the interest of its members, expressing what it believes to be their opinion, as to the necessity of any standard, the kind of a standard it should be, voluntary or enacted, and what should be its content.

In particular, in the *ASA* program the Standards Committee of the Society should provide representation on appropriate sectional committees through appointment of members of the Society to such committees. In the Department of Commerce program similar representation should be provided.

In standards or codes affecting the health and safety of the public where regulations affect the design of heating, ventilating and air-conditioning systems, the Society should not only represent its members but should make available for the protection of the public its best talent to see that these codes are so drawn as to allow the most flexibility in design while providing the greatest possible protection to the public.

In the matter of standards and codes affecting our own Society, the machinery for the creation of such voluntary standards has existed and functioned for years in the Standards Committee.

Another function of the Society in this field is the information service to the members concerning standards. This also has been functioning for years and will undoubtedly continue in the years to come. Not only is information broadcast to all members, but the staff answers many questions through correspondence with individual members.

Function of Local Chapters

A feature of this standards program which requires discussion and thought is the function of the Society's local chapters in relation to local codes affecting the design of heating, ventilating and air conditioning.

Sometimes local chapters are requested to cooperate in writing such codes or in reviewing existing codes. As a society of engineers vitally interested in the subject and believing themselves competent to speak with authority on such matters the local chapter should be prepared to render assistance when requested.

That assistance can be given by a committee selected by the chapter. Whether it should be a chapter committee or a committee named by the governing body at the suggestion of the chapter is a matter that should be discussed and a policy determined.

Another matter that requires discussion is the help which such a local committee should expect from the Society. These codes cannot be handled casually. If the headquarters office staff is to review and comment on such codes, machinery for doing so, which does not exist now, must be created.

Conclusion

The devotion of this session to a discussion of the place of the Society in the standardization program of our nation is in itself a recognition of the importance this organization attaches to this work.

The function of the Society is to represent its members in the creation of standards and to give to its members information concerning existing standards and standards in process in the larger programs of the *American Standards Association*, the Department of Commerce, the fire prevention and safety groups. Also the function of the Society is to create through its own committees codes and standards of interest in this field. The Society is already active and will undoubtedly expand its activities as future developments may require.

II — Commercial and Industrial Standards

First, let me tell you what we at *Air-Conditioning and Refrigeration Institute* (*ARI*) think about standards in general.

Standards have long been an increasingly important function of *ARI* and its predecessor organizations. The first Industry Equipment Standards, 12 in all, were published by the *Refrigerating Machinery Association* in 1938. In succeeding years, new standards were developed and existing standards were revised until today there are 39 *ARI* Standards and collateral publications in print, 12 others are being prepared, with some 18 being currently re-

vised. There is no lack of standards. There is lack of compliance with standards.

The standards developed by *ARI* can perhaps best be described as *equipment* and *application* standards — *i.e.*, stand-

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ards on the products and the application of the products produced by the air-conditioning and refrigeration industry.

The content of the various standards varies as widely as the products covered. Equipment standards may include recommended product definitions, standard and optional equipment, methods of determining and publishing ratings, manufacturing tolerances, minimum performance characteristics, dimensions and other considerations necessary for the proper application of a product. Certain of these provisions are preferably established by reference to other nationally-recognized standards, such as the American Standard Safety Code for Mechanical Refrigeration and the rating and testing standards of professional societies.

I would like to make a distinction between commercial standards and industrial standards. As we understand it, industrial standards are those developed by industry for product improvement and for the advancement of industry and to the benefit of the public.

Commercial standards, again according to our definition, are those standards developed by the government with or without the advice and help of industry but with the same objectives. We at *ARI* believe commercial standards are not necessary in the industrial and commercial refrigeration or in the air-conditioning industry, nor do we believe they are to be preferred to standards developed by our own industry. In this connection, please let me state emphatically that under this definition and this opinion, we do not include Federal Specifications for government procurement. We believe here there is a definite advantage in working together so the requirements of the government can be entirely satisfied and wherever possible with commercially available equipment.

Industrial standards include equipment standards, as well as rating and testing methods and procedures. Equipment standards should be developed by the industry involved. *ARI* accepts that responsibility for its industry as has been indicated.

Like the product covered, the uses to which *ARI* standards are put vary widely. Equipment standards are widely used by manufacturers in the design, sale, and application of their products. Consulting engineers, contractors, and government agencies make frequent reference to these standards in purchase specifications. Requests for the *ARI* standards are constantly received from all parts of the free world and the staff occasionally has to translate a letter written in Spanish or German.

Rating and testing methods or standards are properly and definitely the responsibility of the professional society, or at least, such is the opinion of *ARI*. This has for a long time been our position and still is. If our equipment standards are examined it will be found that regularly we reference the rating and testing standard covering the particular product or products involved, as developed and promulgated by the professional societies such as *ASRE*, ASHAE, *ASME* and *AIEE*. We do this for the perfectly obvious reason that the public should and does accept more readily the findings of a professional society.

That some do not share this belief is evidenced by the fact that some trade associations develop their own rating and testing methods. We believe, however, that in the long run, a higher quality of product and a greater public acceptance of that product will result from our program.

Conformance with the *ARI* standards is completely voluntary. Compliance with any standard should not be claimed, however, unless the product for which such claims are made meets all the provisions of the particular standard.

The Institute does not certify, and has no means of certifying, that any product complies with an ARI Standard.

I question the need for forced compliance, that is, for certification. I believe the continued use of and reference to standards on the part of leading members of our industry will build up a public insistence on buying only those products that will meet the standards.

Let me illustrate with that very popular item, the room air-conditioner. While there are many other very important phases and factors in connection with the design and application of the room air-conditioner, it seems to be necessary to start with the capacity, that is, the output or cooling capacity of a room air-conditioner. *ASRE* has a standard long accepted in the industry that explains how and under what conditions these ratings should be secured, thus, giving a definite standard for comparison of capacities. *ARI*, in Standard 110-55, references this standard of *ASRE* and further states that ratings published by the manufacturers should be such that no unit coming off their production line varies more than 8 percent, plus or minus, from such published ratings. The one thing needed to clear up misunderstanding as to the comparative values of competitive room air-conditioners is to have the manufacturer state in his literature and in his advertising the cooling capacity in Btu per hour as established under *ARI* Standard 110-55. It is just that simple, and there is no excuse for publishing a Btu capacity measured under any other conditions, nor in my humble opinion is there any excuse for not publishing Btu capacities under the conditions, as stated before.

Now may I make a few comments on how ASHAE, or for that matter any professional society, could help in the further development and use of standards, and I am not limiting my comments to you as a group responsible for rating and testing methods only, but include many of you who in one capacity or another are responsible for equipment standards as well.

First: The professional society — your Society — should survey this rapidly growing field of air-conditioning. You should determine in what area standards are lacking. You should determine whether such standards come in your category — or in the category of some other group. Perhaps I am being a little naive in this but I deplore the tendency to overlap and duplicate as between organizations, be they trade associations, government agencies, or professional societies. If you feel there is a need for other equipment standards or applications standards in our industry, please tell us. I would like to feel that comments from us are acceptable to you. For instance, right now we have asked both *ASRE* and ASHAE to endorse — support — or sponsor methods for rating and testing forced-circulation air-cooling and air-heating coils. Such methods have been jointly developed by *ARI* and *HCCMA*. But we want you to adopt these with such modifications as you feel essential and to which we, I hope, can agree.

Second: You should use the industry standards either as consultants when specifying or as engineers employed in design and production. In the latter case, do be more than ever insistent that your company management be thoroughly informed by you of the advantages of using industry standards in design and production, and also of their tremendous importance in advertising and selling.

Third: I would suggest maximum possible speed in the development and promulgation of standards once they are undertaken.

The typical engineer is an individualist and perfectionist. He wants to produce only the ultimate. Agreement among a group is often a tedious process. I do not suggest an inadequate or incomplete or incorrect standard, but I do urge more speed in reaching conclusions. This is particularly important, for instance, in the case of rating and testing methods and procedures when those methods are to be referenced in an equipment standard being developed or already developed by a trade association. Incidentally, it is pretty hard to explain the inability of all groups to get together on such subjects as cooling load estimate forms.

Fourth: This may be presumptuous, but I urge that standards be practical — not so *minimum* as to be worthless — not so restrictive as to limit initiative and ingenuity, but drawn to assure proper quality and performance. Another point, if the

facilities needed to test and rate are too expensive, they tend to defeat their own purpose.

Fifth: This is hard to express — but referring to the individualistic temperament of the engineer, try to reach agreement with the other members of your committee when you serve. I referred previously to the cooling load estimate form — that is a good example. It makes no sense to me, and I am sure it makes even less sense to a prospective customer, when different engineers, different groups of engineers, different trade associations or societies, give different estimates of how many Btu per hour must be taken out of a given structure about which all facts are known in order to get the conditions desired for comfort, health, and efficiency.

And finally, since all standards are developed for the benefit of the public, let us do two things, *viz*:

1. Let us work together — all of us — in the development of desirable standards.

2. Let us use and promote them ourselves. Let us place them in the hands of all interested parties. Let us talk about them. Let us write about them. Let us use every possible means of communication to tell of the value to ourselves and to the public — of standards in American industry.

III — Protective Standards

Development of protective standards has been one of the important activities of this Society for many years. The HEATING, VENTILATING, AIR CONDITIONING GUIDE was a pioneer standard. It has been of inestimable value to many people from the time when the breadth of knowledge in this field was not very great to the present time when knowledge is widespread even though the science is still under development. Such activities are typical of the service rendered by an engineering society, not only to its membership but also to the community at large.

Protective standards first came into existence in this country through regulations developed by state and municipal regulatory bodies. They were contained in factory inspection laws and laid the foundation of what has become a complex system of standards developed by thousands of municipalities, all the states and territories and by various branches of the federal government.

The daily life of every individual is protected through standards in such a commonplace way that very few are conscious that this is so. A simple analysis will serve to show how much this is true.

A person rises in the morning and turns on the light. The electricity for the light comes from the powerhouse to the residence and is distributed throughout the house over a wiring system that is installed according to the requirements of the National Electrical Code, a safety standard. The water for bathing comes through a plumbing system installed under the provisions of a plumbing code — possibly the American Standard plumbing code. The changing of the thermostat not only provides a more comfortable temperature, but the air is cleaned and maintained at the correct humidity both winter and summer. The heating and air-conditioning system is designed and constructed to meet at least the minimum standards established by ASHAE through the work of its various committees.

By this time our average person is ready for some breakfast. Bacon and eggs are in order and so the gas range is put to work. The range not only does a good job of cooking but performs without hazard to the user because it has been tested and approved by the Approval Laboratories of the *American Gas Association*. The approval carries with it the *A.G.A.* seal showing that the range meets the American Standards for safety and performance. When breakfast is over the dishes are washed in water heated by a gas heater that is also approved by the *A.G.A.* Laboratories. But, you say, the range and water heater use electricity instead of gas, so what is the story? It makes no difference because there are also American Standards governing the safety and performance of these appliances.

CYRIL AINSWORTH—Technical Director and Assistant Secretary, *American Standards Association*, New York. From 1922 to 1950 with Department of Labor and Industry of Pennsylvania. From 1930 connected with *ASA;* Assistant Secretary since 1931; Technical Director since 1946 and head of the technical staff and in charge of all technical operations. Member many boards and committees dealing with safety work.

Well, Mr. Average Person is ready to go to work. To get to the office he drives his car, and protecting standards are still with him. The performance of the headlights and brakes is governed by standards that have been approved as American Standard. The same standard governs the wheel alignment. The safety glass in the windshield and other windows is required by every state to meet the requirements of another American Standard. The protection of the driver, however, does not stop with the car. The traffic lights, certainly a protective device, not only are constructed to meet the standards of the *Institute of Traffic Engineers* but the prescription for the colors is also standardized in order that normally color-blind persons, including our average person on the way to the office, can clearly distinguish the colors and thereby drive with safety. The stop signs and warning signs and the street traffic lines conform to standards approved as American Standard.

Well, here we are at the factory and office, and standards are still throwing a protective arm around Mr. Average Person. The office is on the third floor and the elevator swiftly and safely transports its passengers because it has been constructed under the provisions of the elevator code of the city in which the building is located. Probably it is the American Standard elevator code. Oh yes, we forgot, to have an elevator there must be a building in which to install the elevator. But before the building was built, the construction plans had to be approved in order that the city building inspector could be sure that the building would meet the requirements of the Building Code. Such codes are written solely to protect the lives and health of the occupants and the general public.

To recite all the protection given to the workers in the factory and office where Mr. Average Person is employed would take more time than is available here. Practically every operation and every machine is governed by safety standards. The way in which the worker performs his tasks and even the work clothes he wears have standards in back of them.

This story was designed to demonstrate the way in which our everyday life is protected by standards. It is not an exaggerated story even if all the details, including the omitted ones, do not apply to every person in these United States.

The protective standards that have been referred to are of the regulatory type. Extensive as this group of standards is, it is a small group compared with that which includes what is known as engineering, industrial and consumer standards. If we stop to think about this for a minute, we will realize that safety is an integral part of screw thread design and the standards that prescribe such designs. Threads are not just an instrument for fastening 2 or more things together. They are used to fasten things together safely. When under stress they must not yield. If they do, then under many circumstances, death and destruction may result. This is a single example but it would be possible to fill pages in outlining the safety characteristics of the thousands of standards developed by hundreds of agencies on almost every industrial and engineering subject conceivable and used every day in the week by designers, engineers and technologists. And yet with all this protection nearly 100,000 accidental deaths occur annually.

One of the safety slogans in use for many years is *Safety is Everybody's Business*. It is a very true statement. No person and no organization has a corner on safety in any particular field. The national standardization movement, of which the *ASA* is the focal point, has done much to break down any existing jealousies and disputes. Coordination and cooperation in the building of protective standards of all types are an absolute necessity. This is one of the

reasons why the members of *ASA* through the Standards Council are constantly reviewing the procedures for the development and approval of standards as American Standard. They want to make sure that nothing in *ASA* operations will deter any group from using the national clearinghouse for standards, to obtain as wide a scrutiny as possible to insure accuracy and as wide an acceptance as possible. It is one of the reasons why more and more groups are using the national clearinghouse, as *ASA* is known, to secure the widest possible use of the standards which they have developed. In fact, it has come to be recognized that no standard, regardless of where or how developed, can reach its full potential until it receives the designation American Standard, symbolic of national recognition as the only standard in its field to be completely useful.

This Society has been associated in the operations of the *ASA* since the beginning of the safety standards program under our procedures in 1920. It has never failed to lend its support to important changes in *ASA* operations. It has never questioned the appropriateness of a national clearinghouse for standards. This support is one of the reasons why *ASA* has continued to grow in influence and usefulness. The membership and staff of *ASA* look forward to a continuance of this fine relationship and an expansion of it in any way that ASHAE believes desirable.

IV — Governmental Aspects

R. S. DILL—Chief, Heating and Air Conditioning Section, National Bureau of Standards, Washington, D. C. B.S. in mechanical engineering, North Carolina State College. Author many technical papers. Numerous committee assignments ASHAE, including chairman, Committee on Research, 1953 and 1954. Past President Washington, D. C. Chapter ASHAE. Member *ASME, ASRE, ASTM*, Engineers Club of Washington, and others. Registered engineer, District of Columbia.

Mr. Dill's material is not available for printing in this issue of the JOURNAL. However, it is planned to print it substantially in full in the Bulletin now being prepared (and ready soon) to include all the symposium papers together with a digest of the floor discussions. A coupon for use in obtaining this Bulletin appears on page 143 of this issue of the JOURNAL.

V — Laboratory Testing in Development of Codes and Standards

L. N. HUNTER*—Senior Vice President Engineering and Research, National-U.S. Radiator Corp., Johnstown, Pa. B.A.Sc., University of Toronto. President, ASHAE, 1954. Also served on numerous technical advisory committees 1948-49, chairman, Society's Committee on Research. Member *American Chemical Society, American Society for Metals*. Listed *Who's Who in America* and *Who's Who in Engineering*.

Laboratory testing and experimentation should play a very important part in the development of practically all codes and standards and will go a long way towards improving the quality and adequacy of such codes. I am referring particularly to the use of laboratory testing as an aid in the development of the codes in the first place and not necessarily to the inclusion of test requirements in the codes themselves.

Many types of codes and standards are in use for various purposes. There are some, such as those involving standardization of types or sizes, where laboratory testing can be of little help, but such testing is almost imperative where the codes cover equipment or systems and relate to minimum or adequate standards for safety, health, performance, or rating.

An example of the first category is Simplified Practice Recommendation 238-50, which lists various sizes of convector units and types and sizes of cabinets. Examples of the second type of code are the *I=B=R* and *SBI* Boiler Testing and Rating Codes which consist entirely of a procedure developed from laboratory testing.

We probably should define what is meant by laboratory testing. It means experimentation and research investigations conducted in properly equipped laboratories with adequate facilities and capable personnel. The laboratory may be either in industry or in a research or academic institution. Field testing can be included if the tests are controlled to laboratory accuracy.

One of the most important elements in the development of a code is the committee assigned the job. It must consist of competent men and they must have wide experience and *know-how*, and more than a casual interest in the subject. Occasionally the *experts* on the committee do not agree and, if they happen to be rugged individualists who will not compromise their opinions, there will be no code. One effective way of resolving such a situation is by laboratory testing or research. It is necessary, however, that there be agreement among the individuals concerned with the laboratory test procedure itself or the testing program may be in vain.

There may be cases where there is no strong difference of opinion but only some doubt in the minds of the committee members about the adequacy of a requirement. Here, again, the laboratory can be very useful in evaluating the requirement.

Some code requirements are based on empirical formulae in lieu of tests. This is not objectionable if the formulae have been proven satisfactory in all respects because it may avoid testing which is expensive and time-consuming. Laboratory tests can be extremely useful in checking the accuracy of these formulae before they are finally adopted for the code. Empirical formulae that are not thoroughly proven should be avoided.

A technical code must be based on sound engineering principles and must accomplish the purpose for which it was intended, but at the same time must be reasonable and practical. If a code is unduly restrictive, it may defeat its purpose and under such circumstances laboratory testing can frequently provide the data needed to make a practical evaluation of the code requirements. Sometimes code-making bodies find that technical data or principles that would be helpful in the development of codes are not published or are available in rule-of-thumb form only. Here, again, the laboratory can be very valuable in developing the necessary information for proving or disproving the rule-of-thumb methods.

The laboratory can be helpful in developing test procedures for a code and also in checking these procedures before the code is formally approved. Any code that involves test procedures should be checked carefully as a matter of course before it is finally adopted.

All codes should be reviewed frequently by the code-making jurisdiction and revised if necessary to prevent them from becoming obsolete. Otherwise, the code would not serve its intended purpose and might actually retard the development or improvement of the equipment or system it covers. The laboratory should be called upon to develop new data or improve testing procedures required by the code.

A number of trade associations in our field own their own research facilities or carry on research at cooperating institutions. These include such organizations as

*Mr. Hunter was unable to attend the symposium. His material was presented by M. W. McRae, directing engineer, Heating Engineering Dept., Crane Co., Chicago, Ill.

the *Institute of Boiler* and *Radiator Manufacturers, National Warm Air Heating and Air Conditioning Association,* and *the American Gas Association.* These organizations have used their research facilities very effectively to investigate problems relating to the development and revision of codes, and the results have strengthened these codes immeasurably.

Our Society is unique among professional organizations in having our own laboratory and trained staff and is in an excellent position to offer an unbiased service to industry or other code-making organizations. In this way we can serve a very useful purpose and still comply with the Society's established policy on research. The fact that we have the facilities and staff is another strong reason why the Society is well qualified and equipped to take a more active and aggressive policy towards the development of codes and standards of our own.

Summarizing briefly, we believe that a laboratory can be a very useful aid to code development in many respects, as follows:

1. Resolving differences of opinion regarding proposed code requirements
2. Developing basic data for establishing code material
3. Checking rule-of-thumb procedures
4. Insuring that empirical formulae used in codes are reasonable and accurate
5. Developing test procedures for code requirements
6. Checking the accuracy of proposed test requirements
7. Checking for possible errors or oversights in codes before they are finally approved for adoption.

If such tests are made in an impartial laboratory, the results will help to establish confidence in the code by insuring that requirements are not biased.

We hope that the favorable recognition that is being given more and more to the laboratory as a valuable and necessary aid in the development of codes and standards will continue.

We also hope that the Society will show an increase in its interest and activity in the field of codes and standards and use its laboratory facilities and staff to help develop better standards of safety, health, and performance for our industry.

VI — Local and Municipal Standards and Codes

JOHN W. JAMES — President, ASHAE. Vice President of Research, McDonnell & Miller, Chicago, Ill. B.S. in mechanical engineering, Oregon State College. M.S., University of Wisconsin. Many ASHAE committee assignments. Technical Secretary ASHAE, 1935-43. Author text books and many papers. Member numerous technical societies.

In developing a code in which a municipality is involved, there is usually a legal viewpoint to be satisfied. Accordingly the phraseology must be in terms which satisfy the courts and permit enforcement clauses with penalties to be invoked in case violations arise.

Although technical experts generally prepare such codes with the advice and consultation of specialists, it is not uncommon for such codes during public hearings to be influenced by non-technical pressure groups with their own interests to promote.

Most local codes lean heavily on the availability of national standards. For that reason frequent reference is made to recognized handbooks such as THE GUIDE and to installation, testing and rating codes of trade groups and government agencies.

An example of a local code with capable technical direction since its inception is the one developed in the Department of Buildings of the City of Minneapolis, many years ago. It was first known as primarily a Heating Code, but in recent years, all aspects of ventilation, refrigeration and air conditioning have been added.

The Minneapolis code contains frequent references to recognized engineering practices, but this particular code successfully brings all standards together in a workable form so that integration of the various components of the complete system can be accomplished.

There is always debate as to whether a local heating, ventilating and air conditioning code should outline requirements beyond the basic philosophy of protecting the public by minimum health and safety regulations. A detailed examination of the Minneapolis code discloses that several design requirements are included. Some argue that such details should be left to the judgment of the designer or installer and a code should merely outline performance standards to be met. On the other side of the argument, enforcement officers claim that unless certain design requirements are stipulated, constant debate ensues regarding an acceptable installation, and therefore there is justification for inclusion of certain design requirements.

As a result of discussions which took place at many of the Chapters Regional Committee Meetings this spring, it was evident that there was a need for a Code of Minimum Requirements covering heating, ventilating and air conditioning for buildings, which code-writing authorities could use as a guide in the preparation of local standards. For instance, with the expanded School Building Program in progress, it would seem highly desirable for the Society to concentrate on a Code of Minimum Requirements governing the heating and ventilating of school buildings. One difficulty which arises immediately is the problem of developing a code which may be adopted in all parts of the country, with different climatic conditions and local standards of acceptability, but this would be a situation where local practices would influence modification to meet desired objectives.

Even though the Society at the national level accepts the responsibility for developing certain overall code requirements, the chapters can make a contribution by assisting local authorities in drafting codes and ordinances covering our field of interest. Chapter members should be encouraged to participate in the development of such codes and to provide technical assistance wherever needed. However chapters should not become involved in any individual or group activity when the purpose is to influence legislation either for the benefit of the industry or any member or group of the profession.

Because all codes involving engineering are in need of constant review public officials need to recognize that a capable staff of technical experts must be maintained if the revision and administration of such codes is to be successfully accomplished.

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Journal Section

ASHAE representative Walter Sennhauser (left) is greeted by Bundesminister a.D. Dr. Schuberth president of *VDI*, at the 100th Anniversary meeting in Berlin

SOCIETY GREETS *VDI* ON 100th ANNIVERSARY

This year is the 100th Anniversary of the organization of *Verein Deutscher Ingenieure*. Naturally, it was made the occasion of special meetings, and many engineering and technical societies throughout the world were represented.

As the official representative of ASHAE, Walter Sennhauser, chief engineer, Sulzer Bros., Ltd., Zurich, Switzerland, was present for most of the meeting which took place at Berlin in the middle of May.

The formal Anniversary Meeting was held at the Ostpreussen-Halle on Sunday morning, May 13, where a number of official addresses were given.

Mr. Sennhauser reports that by far the most valuable and novel contribution was the lecture by Prof. Dr. Pfender, president of the *Institution for the Testing of Materials*, Berlin, entitled: *Man and his Technology*. Professor Pfender is a very able scientist as well as a philosopher of high standing. His lecture will be published in the German periodical, *Gesundheits-Ingenieur*, in August.

The Grashof Medal, the highest distinction of the *VDI*, was awarded to the well-known Swedish engineer, Mr. Ljungstrom, and to the German professor of thermodynamics, Dr. Schmidt of Munich.

VDI Medals were awarded, among others, to Mrs. Lillian Gilbreth of Montclair, N. J., a famous scientist, consulting engineer, and mother of 12 children. One of these medals also went to E. G. Choisy, president of the *Swiss Association of Engineers and Architects*.

The Anniversary meeting was followed by a luncheon given by the *VDI* to all guests present.

Mr. Sennhauser took part in the special meeting held on May 12, for all foreign delegates and representatives, and at that time conveyed the greetings and best wishes of the Society to the president of *VDI*, who is Bundesminister a.D. Dr. Schuberth.

Mr. Sennhauser was not able to be present at the meeting of the heating and ventilating branch, but his paper on air-conditioning plants was read in his absence by Dr. A. Kollmar, Berlin, who is a well-known radiant heating engineer. Mr. Sennhauser's paper, together with other contributions to the meeting of the heating and ventilating branch, is to be published shortly in *Gesundheits-Ingenieur*.

SUMMARY OF CHAPTER MEETINGS*

• *ATLANTA*: At the annual May dinner dance a brief business meeting was held. Pres. T. A. Barrow, Jr., announced that the following officers will serve for 1956-57: *President*—F. W. Bull; *Vice President*—J. A. Marshall; *Secretary*—J. S. Edgar; *Treasurer*—W. P. West; *Board of Governors*—J. M. Lazenby and T. A. Barrow, Jr. President Barrow introduced each of these officers and thanked the membership for its support throughout the past year. Attendance 226. Attendance ratio 0.65.

• *BATON ROUGE*: *Electronics and Its Effect on Air Conditioning* was the topic of a presentation at the May meeting by C. B. Gamble, Cary B. Gamble & Associates, New Orleans, La. Mr. Gamble, who was introduced by W. B. Martin, Jr., used a series of slides of an actual installation to assist his talk.

Pres. C. S. Woodruff appointed J. L. Webb, F. W. Stone, Jr., and D. W. Chesson as tellers for the election held at the meeting. Mr. Chesson announced the results of the voting: *President*—J. F. Naylor, Jr; *Vice President*—A. W. Holland; *Secretary*—W. J. LeBlanc; *Treasurer*—A. J. Mayers, Jr.; *Board of Governors*—C. S. Woodruff, G. S. Cox and H. J. Weilbacher. L. T. Flanner, Sr., asked for a rising vote of thanks for the outgoing officers in commendation of their excellent work. President Woodruff turned the gavel and charter over to the new president, Mr. Naylor. Attendance 33. Attendance ratio 0.38.

• *BRITISH COLUMBIA*: Pres. Cornelius Van Boeyen welcomed the guests at the Annual May meeting. Reports were given by Treas. R. D. Hale and R. G. MacDonald, publicity chairman. R. A. Malcolm, membership chairman, indicated increased membership during the year, and W. R. Course, attendance chairman, announcing an overall attendance of 48 percent during the season, outlined plans to encourage still greater attendance during 1956-57.

A past president of the Chapter, C. W. Leek, presided over the installation of the new officers: *President*—D. W. Thomson; *Vice President*—A. C. Martin; *Treasurer*—W. F. Wiggins; *Secretary*—W. F. Keenan; *Board of Governors*—C. H. Turland and D. B. Leaney. President Van Boeyen expressed his thanks to the various chairmen for their assistance during the past year.

The program for the evening was devoted to a comparison of the problems encountered in engineering a football team to victory and the everyday problems of the heating and air-conditioning engineer. The guest speakers were Clem Crowe and Vic Lindskog, head coach and assistant coach of the British Columbia Lions football team. Attendance 61. Attendance ratio 0.60.

• *CENTRAL OHIO*: Emphasizing the need for qualified candidates for the engineering school, G. B. Carson, dean, College of Engineering, Ohio State University, discussed *Changing Trends in Engineering Education* at the May meeting. Dean Carson, who was introduced by Program Chairman J. D. Slemmons, urged the Chapter members to use their influence in getting high school students interested in taking engineering education and in preparing in high school for such work. The colorful presentation of engineering in the present-day world was splendidly received.

J. A. Guy, chairman, nominating committee, listed the nominees for 1956-57. They were elected unanimously as follows: *President*—W. A. Schoonover; *Vice President*—T. R. Walker; *Secretary*—R. C. Liebert; *Treasurer*—J. W. Ford; *Board of Governors*—R. A. Wilson, W. V. Jones and C. R. Graf. W. A. Schoonover, president-elect, presented the past president's pin and certificate to retiring Pres. R. A. Wilson. Attendance 111.

• *DELTA*: Reports were given by the various committee chairmen at the May meeting. J. H. Maloney received an ovation for his work on the *Delta Digest*.

Pres. W. B. Martin, Jr., appointed A. R. Salzer, Jr., and P. E. Coe, Jr., to act as tellers for the coming year. Following the reading of the nominating committee's selections and the closing of nominations from the floor, an election was held. The results were: *President*—H. N. Stall; *Vice President*—L. R. Maxwell; *Treasurer*—R. K. Goode; *Secretary*—O. F. Schully; *Board of Governors*—J. H. Maloney and E. H. Sanford. The new officers, who were introduced individually by C. V. Bankston, each spoke briefly. President Martin turned the meeting over to the new president, H. N. Stall, who presented Mr. Martin with a gift expressing the appreciation of the entire membership for his service. Attendance 55.

• *EMPIRE STATE CAPITAL*: A complete report of the year's operation was

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

given by Pres. L. V. Appleby at the May meeting. The installation of new officers was accomplished as follows: *President*—G. G. Davis; *First Vice President*—H. F. Kruger; *Second Vice President*—E. J. Mahoney; and *Secretary-Treasurer*—M. E. Waddell.

John Everetts, Jr., regional director for Region 1, Regions Central Committee, spoke in connection with the new regional plan, outlining its make-up, channels and procedures. His presentation was favorably received by the members, who actively participated in the discussion following. Attendance 21. Attendance ratio 0.34.

• *GOLDEN GATE*: An interesting discussion of the latest advancements in *Solar Heating* was given at the May meeting by Guy Beveviste, research engineer, Stanford Research Institute.

A tellers committee, consisting of J. D. Kniveton, G. N. Aronovsky and L. E. Dwyer, was appointed by Pres. D. E. McLeod. Attendance 54.

• *ILLINOIS*: At the annual past presidents' night held in May, Pres. G. G. Freyder introduced the Illinois Chapter past presidents who were in attendance, and also read letters and telegrams from those who were unable to attend.

C. W. Blodgett presented the board of tellers' report, giving the election results: *President*—H. G. Gragg; *Vice President*—H. E. Anderson; *Secretary*—Herbert Kreisman; *Treasurer*—E. P. Heckel, Jr.; *Board of Governors*—R. J. Salinger, L. H. Streb and E. R. Teske. President Freyder expressed his thanks for the cooperation given him during his term of office, and offered the gavel to the new president, H. G. Gragg. Mr. Freyder accepted the past president's pin from the new president. Expressing his appreciation for the honor accorded to him, Mr. Gragg requested the cooperation of the members.

The sports editor of the *Chicago Daily News*, J. P. Carmichael, was introduced by E. P. Heckel, Jr. Mr. Carmichael spoke on sports in an informative and entertaining manner. Attendance 71.

• *INDIANA*: The presentation given at the May meeting was an illustrated talk by E. F. Snyder, Jr., supervisor control application, Commercial Division, Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. His topic was the *Control of High Velocity or High Pressure Air Distribution Systems.*

Annual election of officers resulted in the following slate: *President*—A. O. Roche, Jr.; *Vice President*—G. W. Vogel; *Secretary*—W. F. Currise; *Treasurer*—J. M. Teskoski; *Board of Governors*—A. B. Keller, W. L. Kercheval and J. W. Jackson. A. O. Roche, Jr., president-elect, outlined the chapter's part in the regional plan, and urged a membership build-up.

Elected to the nominating committee were J. T. Hardin, P. O. Patterson, J. W. Jackson, W. R. Fenstermaker and C. F. A. Locke. The past president's pin was given to Mr. Jackson by Mr. Patterson.

For the first time, the W. T. Miller Award was presented. The recipient was D. B. Doucette, Purdue Student Branch. Second and third prizes were received by other Purdue University students, C. L. Piontek and R. F. Puncochar. Attendance 79.

• *INLAND EMPIRE*: Pres. F. W. Jenkinson appointed K. M. Wood, R. E. Duke and Jack Pearson as tellers to count the ballots at the May meeting. Mr. Pearson announced the officers elected: *President*—Max Tonn; *Vice President*—J. A. Doyle; *Secretary*—R. D. Nevers; *Treasurer*—J. R. Morris; *Board of Governors*—R. O. Haneberg, D. E. Arnold and F. W. Jenkinson.

All the committee chairmen gave annual reports. The new officers were installed by W. F. Kelly, who turned over the gavel to Max Tonn, incoming president. President Tonn presented a desk pen set to the past president, F. W. Jenkinson, as a token of appreciation for his excellent work. Attendance 32. Attendance ratio 0.49.

• *KANSAS CITY*: A special citation for perfect attendance during the year was given by Pres. A. S. Hurt, Jr., at the May meeting to E. K. Campbell, M. M. Harryman, C. D. Hawley, G. F. Hellmer, E. M. Hopkins, A. S. Hurt, Jr., J. E. Miller and R. M. Spencer.

President Hurt announced the death of N. J. Mathey, who had recently been honored by Life Membership.

Those previously nominated were declared elected by unanimous vote of the chapter: *President*—R. M. Spencer; *Vice President*—S. C. McCann; *Secretary*—J. E. Miller; *Treasurer*—J. C. Fasnacht; *Board of Governors*—A. S. Hurt, Jr., J. R. DeRigne, J. S. Dukelow, A. A. Zahner and T. I. Harriman. Past Pres. Hurt delivered the gavel to President Spencer, who presented his predecessor with a past president's lapel pin and a framed certificate, with compliments on the excellence of his administration.

The incoming president introduced the speakers, George Neptune and Edward Meyers, Gustin-Bacon Manufacturing Co., Kansas City, Mo. Mr. Neptune treated the engineering of *Thermal Insulation* and Mr. Meyers' subject was *Acoustical Engineering of Air-Conditioning Systems.* Both talks were well presented, and backed up by an extensive array of actual demonstrations of the effect of insulation. Attendance 81.

• *MEMPHIS*: The entire program given in May was devoted to questions and an-

Members of Purdue Student Branch honored by W. T. Miller Award Committee (l. to r.) R. F. Puncochar, D. B. Doucette, C. L. Piontek

INDIANA CHAPTER MAKES FIRST MILLER AWARD

D. B. Doucette, a senior in the School of Mechanical Engineering at Purdue University, has been announced to be the recipient of the W. T. Miller Award for 1956. The award was established by the Indiana Chapter of ASHAE to strengthen the Purdue Student Branch and to create a greater interest among students in the fields of heating and air conditioning.

The award consists of a permanent plaque to be hung in the Mechanical Engineering Building with the recipient's name to be added to the plaque each year. Mr. Doucette also received the best books in the field of air conditioning, a library of 15 books valued at approximately $100.

Honorable mention was given to R. F. Puncochar and C. L. Piontek, each of whom received several books valued at approximately $50.

The members of the Indiana Chapter Award Committee were: W. F. Currise, chairman; S. E. Fenstermaker, Jr., and F. B. Morse, who is faculty adviser of the Purdue Student Branch at the University.

Journal Section

sewers pertaining to the City of Memphis Building Code, as applying to refrigeration and air-conditioning installations. Pres. W. L. Henson introduced the speaker, D. L. Canaday, refrigeration inspector, the City of Memphis.

President Henson appointed R. E. Larkin, John Hilton, II, Robert H. Bolding and W. L. Drake to the picnic committee.

• *MICHIGAN*: At the annual golf meeting held in May, Pres. D. S. Falk asked for the report of the tellers committee. The results of the ballots were: *President*—J. N. Livermore; *Vice President*—P. P. Hosman; *Secretary*—J. B. Olivieri; *Treasurer*—K. J. Wagoner; *Board of Governors*—Axel Marin, G. S. Whittaker and J. G. Black, Jr. Past Pres. R. H. Oberschulte installed the new officers.

Golf awards were distributed by G. J. Andrew and E. J. Anderson.

• *MISSISSIPPI*: Secy. M. F. Knipp, Jr., read an amendment, regarding meeting times and elections, at the regular May meeting. The nominating committee report was read by Burt Lomax, Jr. Pres. B. L. Palmer presided.

An interesting talk on *Remote Fan Coil Units* was given by H. H. Clark, who was introduced by R. E. Vernon. Attendance 29.

• *NEW YORK*: Seven past presidents were in attendance at the May meeting when Pres. Albert Giannini summarized the progress of the Chapter during the past year and expressed his appreciation for the cooperation he received from the other officers. He noted with pleasure that this last meeting of the year was also the best attended, and indicated that the subject selected was one of real interest to the members.

A Life Membership certificate was presented to H. L. Janet by P. B. Gordon, Society first vice president, New York, N.Y.

President Giannini introduced the newly elected officers. After accepting the gavel, J. B. Hewett, the incoming president, called on W. L. Fleisher, who made a surprise presentation of a plaque to retiring President Giannini.

Mr. Hewett, program chairman, introduced John Everetts, Jr., member of Council, who is connected with Charles S. Leopold, consulting engineer, Philadelphia, Pa. Mr. Everetts presented his talk on *Cost Versus Velocity in High Velocity Distribution Systems.*

• *NORTH JERSEY*: *Air Cooled Package Units* was the topic covered at the May meeting by E. F. Borgos, superintendent of applied engineering, General Electric Co., Bloomfield, N.J. Pres. C. H. Smith introduced the speaker.

President Smith gave a report on his stewardship as president for the past year, and then turned the gavel over to Past Pres. H. M. Patrick for the installation of the new officers. Treas. S. H. Nitzberg gave an annual report. The auditing committee, consisting of P. H. Oppenheimer and F. S. Frambach, announced that they had found the annual report to be in order.

C. Raymond Morris was tendered his Life Membership certificate.

• *NORTH TEXAS*: C. L. Zahn introduced his fellow committee men for the May meeting, B. R. Miller and R. M. Williamson. Mr. Zahn also presented the guest speaker, Paul Leonard, Leonard's Department Store, Fort Worth. Mr. Leonard described the Gruen plan which is proposed for Fort Worth. The plan provides for the redevelopment of a large downtown area of the city. It would call for closing this section to surface vehicular traffic, with all traffic flow into the perimeter of the area on freeways and with ample parking facilities an integral part of the redevelopment. Subsurface access drives would be provided for loading and unloading trucks. The redevelopment envisions retaining many present major buildings, while making modifications, adding a civic center and creating parks.

Following the talk, a film highlighting last year's 500-mile race at Indianapolis was shown by A. W. Stubbeman.

Pres. H. G. Gregerson announced that J. R. Dowell had been appointed chairman of a committee for the solicitation of Giesecke Fund contributions. Attendance 109. Attendance ratio 0.37.

• *NORTHERN ALBERTA*: Pres. W. C. Woods presided at the May meeting. The matter of chapter dues was discussed and settled. The proposed chapter by-laws were presented by the by-laws committee, under the chairmanship of Harry Hole. A motion to adopt these by-laws was carried.

G. T. Christie, Winnipeg, Manitoba, brought greetings from the Manitoba Chapter. Attendance 42.

• *NORTHERN OHIO*: By unanimous vote at the May meeting the new slate of officers was elected: *President*—H. R. Canoyer; *Vice President*—R. E. Leising; *Secretary*—R. D. Wilson; *Treasurer*—R. A. Urban; *Board of Governors*—L. C. Burkes, J. L. Frisse and Sherwood Nassau.

Pres. L. C. Burkes announced that D. E. Mannen had been elected president of the *Ohio Sheet Metal Contractors' Association.* B. A. Schwirtz, program chairman, introduced Mr. Mannen, who acted as moderator for a panel discussion on *Specifications.* The panel included C. E. Hansen, vice president, The Smith & Oby Co., Cleveland, Ohio, representing the contractor; C. M. Hinsdale, specifications writer for Garfield, Harris, Robinson and Schafer, architects; and R. L. Byers, partner, with John Paul Jones, Cary & Millar, Cleveland. Discussions included the *or equal* clause, the all-inclusive *grandfather* clause, standardization of duct gages and other subjects of interest to contractors and designers. Attendance 85.

• *OKLAHOMA*: The officers elected at the May meeting to serve for 1956-1957 are: *President*—F. R. Denham; *Vice President*—A. C. Shelley; *Secretary*—W. R. Johnson; *Treasurer*—W. H. Stewart; *Board of Governors*—W. J. Collins, Jr., E. F. Dawson, and J. R. Patten.

After the business meeting was ended, a film entitled *Please Pass the Condensate—Steam Traps at Work* was shown, furnished by the Yarnall-Waring Co., Philadelphia, Pa. Attendance 52. Attendance ratio 0.37.

• *ONTARIO*: In the absence of the retiring president D. L. Angus, who is visiting England, M. C. Bailey took the chair at the May meeting. After reports were received from the various committee chairmen, officers for the coming year were made known as follows: *President*—C. J. Bootes; *Vice President*—Charles Torry; *Secretary-Treasurer*—H. R. Roth; *Board of Governors*—Jack Thompson, R. A. Ritchie, Ernest Fox and D. L. Angus (Ex-Officio).

Newly-elected President Bootes assumed the chairmanship of the meeting and introduced J. H. Ross, moderator of a panel consisting of J. F. O'Neill, J. D. Coates and W. T. E. Duncan. The subject under consideration was *Will Non-Freeze Coils Freeze?* Members found the subject extremely interesting and an audience discussion period followed the panel discussion. Attendance 115.

• *OREGON*: *Natural Gas Burners and Their Application* was the subject of a talk expertly presented by G. C. Bergtholdt, chief engineer, The Webster Engineering Co., Tulsa, Okla., at the May meeting presided over by Pres. W. R. Norte. Mr. Bergtholdt, who was introduced by D. L. Benz, emphasized that natural gas is not a cure-all for poor equipment and faulty draft conditions and that proper sizing of equipment, adequate fresh air supply to gas burners, manifold pressure, orifice sizes and the velocity of gases are all important factors in each job. The speaker described four types of basic combustion safeguards and advised against striving for higher than a 9 percent CO_2 reading as a general rule. He also insisted upon the cleaning of existing equipment due for conversion. Mr. Bergtholdt's talk stimulated a vigorous discussion among members.

After the talk, President Norte presented last year's president, Dick Blankenship, with a set of bookends as a recognition of his past services. Attendance 89. Attendance ratio 0.38.

• *OTTAWA VALLEY*: *Fans and Coils as Applied to Ventilating* was the topic presented at the April meeting by J. F. O'Neill, chief applications engineer, The Trane Co. of Canada, Ltd., Toronto. Mr. O'Neill, who was introduced by J. L. Neilans, dealt mainly with air supply systems utilizing coils on sub-freezing entering air conditions. The speaker discussed industrial exhaust systems and their design and installation; the necessity of tempered air, particularly where the comfort and efficiency of employees is concerned; and the waste of fuel often seen in large ventilation systems. Mr. O'Neill pro-

vided an interesting illustration of a *run-around* heat recovery system, and gave some useful recommendations on the use of single-tube and orificed steam distributor double-tube coils, depending on steam pressure and method of control utilized. C. W. Watson expressed the chapter's appreciation to Mr. O'Neill. Attendance 49. Attendance ratio 0.59.

• *PACIFIC NORTHWEST*: The main item of business at the May meeting presided over by Pres. P. I. L. Winsor was the announcement of officers for the coming year: *President*—L. F. Christofferson; *First Vice President and Delegate*—E. W. Triol; *Second Vice President and Alternate Delegate*—M. W. McKinstry; *Secretary*—H. M. Hendrickson; *Treasurer*—R. H. Liniger; *Board of Governors*—T. C. Caskey and K. G. Massart.

Before the formal installation of the new officers, the newly-elected president, still acting in his former capacity as program chairman, introduced the speaker, E. G. Carrier, Carrier Corp., San Francisco, Calif. Mr. Carrier spoke on the *Recent Development in Package Type, Centrifugal and Steam Absorption Water Chillers* and his interesting presentation of his subject was received with interest. The speaker was thanked by the retiring president, P. I. L. Winsor.

The new officers were then installed and the gavel was turned over to Pres. Christofferson. Attendance 87. Attendance ratio 0.51.

• *PITTSBURGH*: A Past President's Pin was presented to the retiring president, C. L. Benn, by a former president, T. F. Rockwell, at the May meeting of the chapter. A set of luggage was also presented to E. H. Riesmeyer, Jr., the retiring secretary, in recognition of his services to the chapter for the past thirteen years.

Officers elected for the coming year were: *President*—R. M. Toucey; *Vice President*—E. H. Riesmeyer, Jr.; *Secretary*—G. E. Smetak; *Treasurer*—R. C. Firsching; *Board of Governors*—C. L. Benn, E. J. Busch, and Stanley Stake. Attendance 102.

• *SOUTH CAROLINA*: Annual reports were presented by the committee chairmen of the Membership, Program, Publicity, Attendance and Reception, and Finance Committees at the May meeting, Pres. R. K. Rouse presiding. Reports were also heard from the chairmen of the Auditing Committee and the Special Events Committee, and from the Board of Governors and the Treasurer.

Officers for 1956-1957 were announced as follows: *President*—J. E. McMurray; *Vice President*—B. A. Leppard; *Secretary*—A. L. Blackstone, Jr.; *Treasurer*—H. J. Haar, *Board of Governors*—Harry McKeown, H. W. Hood and R. K. Rouse. The meeting was then turned over to President McMurray. Attendance 32. Attendance ratio 0.33.

• *SOUTHERN CALIFORNIA*: *Engineers' Place in Fire Prevention* was the title of a talk given at the May meeting by Loren Bush, chief engineer, Fire Underwriters of the Pacific. Mr. Bush was introduced by H. B. Nottage, chairman of the chapter Codes and Standards Committee, who also remarked on the second conference for fire prevention held prior to the regular meeting.

Officers elected at the meeting were: *President*—H. F. Ulovec; *Vice President*—W. J. Biggar; *Secretary*—A. Z. Levine; *Treasurer*—R. W. Thomas; *Board of Governors*—Albert Zimmerman, R. C. Taylor, Lee Hutchinson, Jr., and G. D. Lord. Attendance 75.

• *SOUTHWEST TEXAS*: A joint meeting of the Southwest Texas Chapter and the Austin Chapter was held in April under the chairmanship of its acting president, Bernard Segall, Jr. Acting President Segall, after opening the meeting, turned it over to F. B. Frazee, president of the Southwest Texas Chapter. A report was heard from the nominating committee, and members were appointed to serve on the auditing committee.

The speaker of the evening, Lee Krape, General Electric Co., Dallas, Tex., was introduced by A. C. Lagow, vice president, Austin Chapter. Mr. Krape gave a very informative talk on *The Trend of Home Air Conditioning*. He said that pre-war air conditioning was much of a *hit-and-miss* business, until a substantial market came into being after the war and proper equipment was produced for home use. Mr. Krape said that manufacturers are now striving to make residentially designed equipment which will be less costly to maintain and install. A discussion period took place after the speaker had concluded his talk. Attendance 35.

• *TOLEDO*: Officers elected at the May meeting were as follows: *President*—J. F. Guest, *Vice President*—J. M. Groskopf; *Secretary*—Robert Greenwald; *Treasurer*—D. L. Wilson; *Board of Governors*—F. C. Richardson, Jr., G. A. Kelley, and R. O. Benington, Jr.

Mr. Greenwald was complimented by the retiring president, C. F. Hoffman, on the two articles which he wrote appearing in the Toledo Technical Topics for May, and a letter was read by the Secretary from A. V. Hutchinson, ASHAE Executive Secretary, commending the committee in charge of the Regional Committee meeting for a job well done.

The program chairman, D. L. Wilson, then introduced the guest speaker, Edward Jackson, Jr., director of alumni and graduate placement, University of Toledo, who spoke on *Placement Opportunities for the College Graduate Today*. Attendance 33. Attendance ratio 0.43.

• *VIRGINIA*: The *Economic Aspects of Packaged Liquid Chillers* were the consideration of the May speaker, Duane Merrill. The program chairman, A. B. Miller, called upon Glen Breeden to introduce the speaker. Pres. C. G. Conaway, Jr., was the presiding officer. Attendance 26. Attendance ratio 0.30.

• *WESTERN MASSACHUSETTS*: John Everetts, Jr., engineer, Charles S. Leopold, consulting engineer, Philadelphia, Pa., the regional director, Chapters Regional Committee for Region 1, spoke at the April meeting on the purposes of the regional system as adopted by the Society. Mr. Everetts also described the function of the Regional Meeting. The chapter meeting was presided over by Vice Pres. J. E. Reed.

R. W. Lawrence, commercial sales engineer, Minneapolis-Honeywell Regulator Co., Hartford, Conn., discussed the *Four Freedoms of Electronic Control*, in which he described its flexibility and convenience. He was introduced by Vice Pres. J. E. Reed. Attendance 30. Attendance ratio 0.37.

• *WESTERN MICHIGAN*: Pres S. M. Paganelli presented chapter Life Membership cards to L. G. Miller and C. R. McConner at the May meeting. The new officers for 1956-1957 were then announced as follows: *President*—F. L. Murray; *Vice President*—B. J. Walter; *Secretary*—R. J. Waalkes; *Treasurer*—K. L. Lamm; *Board of Governors*—S. M. Paganelli, R. R. Kingscott and William Wessels. President Murray then accepted the chapter charter for the coming year from the retiring president.

The induction of the incoming officers was made by H. D. Bratt and J. L. Alexander, who advised them of their duties and responsibilities. In conclusion, C. H. Pesterfield presented the Past President's Plaque to Mr. Paganelli. Attendance 81.

• *WESTERN NEW YORK*: ASHAE second Vice Pres. E. R. Queer, director and professor of engineering research, The Pennsylvania State University, University Park, Pa., presented Life Membership Certificates to C. C. Cheney and M. C. Beman at the May meeting presided over by chapter Pres. C. W. Kaupp. President Kaupp then announced the incoming officers for 1956-1957 as follows: *President*—V. N. Harwood; *First Vice President*—G. E. Kuhn; *Second Vice President*—J. P. Guerra; *Secretary*—J. F. Bedard; *Treasurer*—M. C. Beman; *Board of Governors*—C. W. Kaupp, M. C. Beman, C. W. Stone, Joseph Davis and Roswell Farnham.

A talk on *Air Conditioning Caves for Storage* was given by Professor Queer at the conclusion of the business meeting, and he also discussed the mechanics of the Regional Plan. Professor Queer was introduced by V. N. Harwood. Attendance 51.

• *WISCONSIN*: Society President John W. James, Chicago, Ill., addressed the chapter at the May meeting on *The History and Growth of the Society*. He placed particular emphasis on the research laboratory, and what the air conditioning industry does to help mankind. President James also presented the Gustus L. Larson award to R. L. Kausch, a junior in the mechanical engineering school at the University of Wisconsin.

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Prior to President James' speech, G. H. Szekely was personally thanked by the chapter president, I. J. Rossiter, for his services as delegate to the National Convention and chapter delegate to E.S.M.

The meeting was adjourned with a rising vote of thanks to the Society President. Attendance 66. Attendance ratio 0.20.

Student Branches

• *NORTH CAROLINA STATE COLLEGE*: Following a brief business meeting held on May 15, the ASHAE students in attendance joined the *ASME* meeting which was called to honor the graduating seniors. Attendance 11.

• *NORTH CAROLINA STATE COLLEGE*: Election of officers at the May 1st meeting produced the following slate for 1956-57: *President*—P. K. Tuggle; *Vice President*—J. G. Daye; *Secretary*—G. L. Waitman; and *Reporter*—M. K. Sloan.

Pres. R. E. Crawford reported that for the fifth consecutive year the mechanical engineering department had been awarded the first prize in the Engineer's Fair. B. C. Wilson was appointed as picnic chairman.

• *PURDUE UNIVERSITY*: A day long field trip to 3 nearby industrial plants was held on May 22. At the Delco Radio Division, General Motors Corp., Kokomo, Ind., the group was shown the new and fully equipped air-conditioning and heating system in operation. Ed. Roepstorff, assistant plant engineer, and James Wilson, of the engineering staff, provided complete information about the system. The students and faculty advisor, Prof. F. B. Morse, then proceeded to Indianapolis, Ind., to visit the main plant of the Allison Division, General Motors Corp. Here they inspected the heating and air-conditioning system installed in the office area of this plant, and viewed the Powerama display. R. I. Drum acted as host. Later in the afternoon they went to Eli Lilly & Co., Indianapolis, where they saw the various methods and equipment used in the control of humidification. B. G. Evans, manager of engineering maintenance departments, spoke on the necessity for humidity control, the problems involved, and their solution.

In the evening, the Purdue Student Branch joined the Indiana Chapter for a regular meeting, at which the first W. T. Miller award was made. Attendance 24. Attendance ratio 0.60.

• *PURDUE UNIVERSITY*: Students elected at the meeting on May 8 to serve for the next semester were: *President*—R. F. Puncochar; *Secretary*—G. T. Vail, Jr.; and *Co-ordinator*—Richard Schultz.

Prof. F. B. Morse, faculty advisor, at whose home the meeting was held, served refreshments following the meeting. Attendance 27. Attendance ratio 0.54.

• *UNIVERSITY OF DETROIT*: L. J. Hayes, Jr., student branch chairman, called the meeting of May 2nd to order. J. B. Olivieri, chief mechanical engineer, Victor Gruen Associates, Inc., architects and engineers, Detroit, Mich., talked on *Heating, Ventilating and Air Conditioning for Shopping Centers*. An informal discussion period followed.

Attendance 13. Attendance ratio 1.00.

CANDIDATES FOR MEMBERSHIP

Listed here are the names of 88 men who are candidates for membership or advancement in membership grade.

Members are requested to assume their full share of responsibility of receiving these candidates into membership by advising the Executive Secretary before August 31, 1956, of any whose eligibility for membership is questioned. Unless such objection is made these candidates will be voted upon by the Council.

Note: †Reinstatement *Advancement

California (*Region* 4)

BAKER, H. W., Sales Engr., MILMAC, San Francisco.

BURR, D. G., Sales Engr., Grinnell Co., San Francisco.

GARRISON, J. F., Mech. Engrg. Design-Project Lead Man, Daniel, Mann, Johnson & Mendenhall, Los Angeles.

GOTT, D. J.*, Western Regional Mgr., Detroit Controls Corp., Los Angeles.

GUTTMANN, KARL, Design Engr., Edward Hill, Jr., Cons. Engr., San Francisco.

ROHR, L. C., Mech. Engr., Koebig & Koebig, Cons. Engrs., Los Angeles.

WILKERSON, E. H., Sr. Designer, Fluor Corp., Ltd., Los Angeles.

Connecticut (*Region* 1)

O'DONNELL, J. C., Dist. Repr., Minneapolis-Honeywell Regulator Co., New Haven.

District of Columbia (*Region* 5)

ROGERS, H. L., Owner, Harry L. Rogers, Washington.

Florida (*Region* 5)

GIBSON, W. H., Cons. Engr., West Palm Beach.

Georgia (*Region* 5)

BAKER, W. L., Jr., Jr. Engr., D. F. Lindstrom & Assocs., Atlanta.

WILKINS, GRANT, Repr., American Radiator & Standard Sanitary Corp., Atlanta.

Illinois (*Region* 2)

HARRISON, J. A., Vice Pres., M. Brucker, Inc., Chicago.

KEARNEY, J. M., Regional Sales Mgr., Anemostat Corp. of America, Chicago.

KOUDOUNARIS, ANGELO, Engr., The Pyle-National Co., Chicago.

LOYD, W. H., Jr., Graduate Asst., University of Illinois, Urbana.

SMITH, J. P., Mech. Engr., R. G. Burkhardt & Assocs., Chicago.

YOUNG, W. G., Chief Appl. Engr., Barber-Colman Co., Rockford.

Indiana (*Region* 2)

RAHN, A. E., Estimator, Hayes Brothers, Inc., Indianapolis.

Iowa (*Region* 3)

KNIGHT, J. D., Treas. & Htg. Engr., Winterbottom Supply Co., Waterloo.

Kansas (*Region* 3)

BRICKER, F. C., Div. Engr., S. A. Long Co., Inc., Wichita.

Kentucky (*Region* 5)

YOUNG, C. W., Jr., Partner, Pritchett & Young, Madisonville.

Louisiana (*Region* 5)

DENSON, L. L., Sr. Engr., B. M. Dornblatt & Assocs., Inc., New Orleans.

WALDO, M. E., Partner, Waldo Brothers, New Orleans.

Maryland (*Region* 5)

BERLIN, J. H., Htg. Engr., E. G. Schafer & Co., Silver Springs.

GRICE, J. F.*, Mech. Engr., Henry Adams, Inc., Baltimore.

Massachusetts (*Region* 1)

LEVENSON, D. B., Mech. Designer, Chas. T. Main, Inc., Boston.

MARTIN, W. G., Jr.*, Sr. Sales Engr., Johnson Service Co., Cambridge.

Michigan (*Region* 2)

TENNANT, E. M.*, A-C. Engr., Geo. Wagschal Assoc., Inc., Detroit.

Minnesota (*Region* 3)

JACKSON, R. S., Sales Engr., E. W. Reinertsen, Minneapolis.

Missouri (*Region* 3)

HARRIMAN, T. I.*, Sales Engr., American Blower Corp., Kansas City.

JOURDAN, J. J., Assoc., C. J. R. McClure & Assocs., Kirkwood.

MCGOVERN, D. E., Sales Engr., Johnson Service Co., St. Louis.

SUREN, R. G., Sales Engr., Johnson Service Co., St. Louis.

TOBEY, R. W.*, Sales Engr., The Trane Co., Kansas City.

Nebraska (*Region* 3)

GESSNER, G. A., Mech. Design Engr., Harold Hoskins & Assoc., Lincoln.

New Jersey (*Region* 1)

MCCROBY, R. J., Jr., Dist. Repr., L. J. Wing Manufacturing Co., Linden.

New Mexico (*Region* 6)

HOOD, P. H., Pres., General Metal Products., Inc., Albuquerque.

New York (*Region* 1)

COBURN, A. E., Editor (*Gas Heat*), Heating Publishers, Inc., New York.

ESTREICH, P. J., Designer, Kerby Saunders, Inc., New York.

JACKSON, L. S., Mgr., House Htg., Com. Sales, Long Island Lighting Co., Mineola.

North Carolina (*Region* 3)

FARTHING, E. H. G., Mgr., A-C. Dept., Parks-Cramer Co., Charlotte.

HARGETT, B. M., Sa., Dist. Mgr., Barber-Colman Co., Charlotte.

HIPP, C. R., Treas., Frederick Raff Co., Charlotte.

JONES, E. C.*, Pres., Engineering, Inc., Charlotte.

Ohio (*Region* 2)

HANLON, E. T., Sales Engr., Johnson Service Co., Columbus.

MATSON, D. C., Mech. Engr., Bellman, Gillett & Richards, Toledo.

O'CONNOR, J. J., JR., Sales Engr., Armstrong Cork Co., Cincinnati.

Oklahoma (*Region* 6)

KIRCHOFF, J. H., Chief Engr., W. F. Glenn Co., Mech. Contrs., Tulsa.

Oregon (*Region* 4)

ADAMS, W. M., Sales Repr., Vermiculite Contractors, Inc., Portland.

GRAY, R. F., Mfrs. Agt., Portland.

Pennsylvania (*Region* 1)

HENDERSON, J. K., Engr., R. J. Sigel, Cons. Engr., Narberth.

JUNGJOHANN, P. P., Field Service Engr., A. M. Byers Co., Pittsburgh.

LOWREY, J. F., Supvsr., Philadelphia Electric Co., Philadelphia.

Tennessee (*Region* 5)

WADE, H. W., Sales Repr., Minneapolis-Honeywell Regulator Co., Memphis.

Texas (*Region* 6)

BAILEY, J. F., Sales Engr., Leo J. Freitas Co., Inc., Dallas.

JAMES, C. M., Owner, C. M. James Co., Austin.

MCDANIEL, W. D., Sales Engr., Leo J. Freitas Co., Inc., Dallas.

SCHEIB, J. R., Asst. Engr., Board for Texas State Hospitals and Special Schools, Austin.

Virginia (*Region* 5)

HURT, L. W., Machinery Designer, Newport News Shipbuilding & Dry Dock Co., Newport News.

Washington (*Region* 4)

ALLEN, R. R., Mech. Engr., John Graham & Co., Seattle.

KELLY, A. P., Htg. Repr., American Standard Corp., Seattle.

SNORSKY, R. W., Mgr., Jan-Pacific Co., Seattle.

West Virginia (*Region* 5)

HOLTZWORTH, R. H., JR., Vice-Pres., R. H. Holtzworth & Sons, Inc., Huntington.

Wisconsin (*Region* 2)

STEPHAN, F. P., Proj. Engr., The James Mfg. Co., Ft. Atkinson.

Canada (*Region* 7)

ALGIE, W. L.*, Mgr., Crane Assocs., Manitoba Sales Office, Winnipeg, Man.

BARRY, RENE, Vice Pres., O. Picard & Fils, Inc., Quebec, Que.

BEAUDET, J. L., Owner, J. L. Beaudet, Inc., Quebec, Que.

BEDARD, RAYMOND, Htg. & Vtg. Engr., Leblanc, Montpetit & Dorval, Quebec, Que.

BONNEAU, L. P., Vice-Dean, Faculty of Science, Laval University, Quebec City, Que.

CORNWELL, R. B., Pres.-Owner, Industrial Sheet Metal Works, Ltd., Vancouver, B. C.

IRONSTONE, S. R., Asst. Tech. Supvsr., Indus. & Com. Sales, Consumers Gas Co., Toronto, Ont.

LACROIX, MARCEL, Engr., J. L. Demers, Ltd., Levis, Que.

LOWE, H. T., Western Repr., General Controls Co., Canadian, Ltd., Winnipeg, Man.

MCDONALD, A. A., Inspector, Heat & Power Engineering, Vancouver, B.C.

MCLEAN, A. W., Sales Engr., Trane Co. of Canada, Toronto, Ont.

NADEAU, GEORGES, Mgr., La Salle Builders Supply, Ltd., Quebec, Que.

O'KELL, PETER, Sales Mgr., Nyberg Plumbing & Heating Supplies, Ltd., Peterborough, Ont.

ROBITAILLE, STEPHANE, Inspector in charge of Misc. Elec. Engrg., Inspection Services, National Defence, Federal Govt., Montreal, Que.

ROBOZ, STEVEN, Mgr., Indus. Dept., Pacific Propane, Ltd., S. Westminster, B.C.

ROUILLARD, J. L., Pres., J. E. Rouillard, Ltd., Quebec, Que.

SERVANT, AZARIAS, Mgr., Combustion Dept., Tri-Bec, Inc., Quebec, Que.

WATSON, J. J., Mgr., Economy Gas Conversion Co., Toronto, Ont.

ZACHARY, R. Z., Mech. Engr., Alberta Government, Edmonton, Alta.

England

GARDNER, JOHN, Sr. Partner, J. Gardner & Co., Aylesbury, Buckinghamshire.

Holland

SPRONG, HANS, Sales Engr., N. V. Louis Reyners, Amsterdam.

Pakistan

PFAENDLER, FRITZ, Mgr., Engrg. Dept., Ali Automobiles, Karachi.

Journal Section

Puerto Rico

CRUZ, J. L., Pres., Jose L. Cruz & Co., Rio Piedras.

OBITUARIES

FRANK L. GRAY, JR.
Dallas, Tex.

Word has been received from the North Texas Chapter of the death of Frank L. Gray, Jr., 34, at his home in Dallas, following a heart attack. He was currently serving as program chairman for the North Texas Chapter, and for several years preceding had been the editor of *The Texas Norther*, a chapter publication.

Mr. Gray, who was born in Gary, Ind., received his BSME from Purdue University in 1943. After graduation, he joined the Dow Chemical Co. for a short period. For eight years following he was associated with Carrier Corp. as an engineer working on design and application. Since 1952 he was connected with Ray Engineering Co. as a sales engineer. His duties included consultation with architects and engineers, and layout of heating systems.

Besides his membership in ASHAE, which he held since 1954, Mr. Gray was a member of the *Texas Society of Professional Engineers* and the Engineers Club of Dallas. He was also a deacon in the East Dallas Christian Church.

Survivors are his wife, Jane; two daughters, Barbara, 10, and Patricia, 4; his brother, John; and his parents, Mr. and Mrs. Frank L. Gray, Gary, Ind.

ORVILLE PRATT
Omaha, Nebr.

Orville Pratt, 51, a member of the Nebraska Chapter, died on May 7. He was an engineer for the United States Supply Co., Omaha, Nebr.

Mr. Pratt's birthplace was Marshalltown, Ia. He studied at Omaha University and began his career with the Natkin Engineering Co. in 1922. He was also connected with B. Grunwald, Inc., before joining the United States Supply Co. in 1933.

Besides holding membership in the Society since 1953, Mr. Pratt was also a member of *ASME*. He is survived by his wife, Dorothy; two daughters, Mrs. Jane Mitchell, Council Bluffs, Ia., and Nancy Fay Pratt, Omaha; his mother, Mrs. Minnie Pratt, Omaha; and a granddaughter, Kimberley Kay, Council Bluffs.

DOUGLAS W. SHAND
Montreal, Que., Can.

A popular member of the Montreal Chapter, Douglas W. Shand, 47, district

Journal Section

sales manager, Darling Brothers, Ltd., Montreal, Que., Can., died on April 15 at the Montreal General Hospital following a lengthy illness.

Mr. Shand, a native of Montreal, was connected with Darling Brothers, Ltd., for the past 25 years. He had been serving as Montreal district sales manager and advertising manager.

Active in local affairs, he was a member of the council of the municipality of Pointe Claire and had been instrumental in assisting in the planning and construction of an extensive addition to the municipal waterworks system. He was a member of Valois United Church and acted as a justice of the peace for the Montreal district. Besides membership in ASHAE, which he held since 1952, other organizations Mr. Shand belonged to were the *Canadian Association of Refrigeration and Air Conditioning, The Institute of Power Engineers*, and the Montreal Advertising and Sales Executives Club.

He is survived by his widow, Anna; a daughter, Barbara (Mrs. Philip Hilliard); and two sons, Robert M. and David E.; all of whom live in Valois, Que., where Mr. Shand had long been a lakeshore resident. Also surviving are his mother, Mrs. Mary Shand; a sister, Mrs. Norman Annand, Montreal; and a brother, Ronald, Labrieville, Que.

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Maine			
Mass.	Mass. (Boston)	G. D. Fife	W. G. Martin, Jr.
Mass.	West. Mass. (Springfield)	A. M. Lovenberg	S. K. Smith
N. H.			
N. J.	No. Jersey (Newark)	C. H. Smith	R. C. Kruse, Jr.
N. Y.	Central N. Y. (Syracuse)	L. A. Childs	H. J. Morton
N. Y.	Emp. St. Capital (Albany)	L. V. Appleby	M. E. Waddell
N. Y.	New York	J. E. Schechter	Albert Giannini
N. Y.	West. N. Y. (Buffalo)	C. W. Stone	Van Ness Harwood
Pa.	Philadelphia	E. K. Wagner	P. H. Yeomans
Pa.	Pittsburgh	R. M. Toucey	B. B. Reilly
R. I.			
Vt.			

Region 2 — Regional Director: C. H. Pesterfield

Ill.	Illinois (Chicago)	G. G. Freyder	H. G. Gragg
Ind.	Indiana (Indianapolis)	James Jackson	A. O. Roche
Mich.	Michigan (Detroit)	E. F. Glanz	D. S. Falk
Mich.	West. Mich. (Grand Rapids)	S. M. Paganelli	F. L. Murray
Ohio	Cent. Ohio (Columbus)	J. A. Guy	R. A. Wilson
Ohio	Cincinnati	A. H. Gerdsen	R. G. Anderson
Ohio	Miami Valley (Dayton)	D. E. Tullis	J. B. Rishel
Ohio	No. Ohio (Cleveland)	H. R. Canoyer	J. A. White
Ohio	Toledo	C. F. Hoffman	J. J. Heilman
Wis.	Wisconsin (Milwaukee)	L. C. Plaehn	L. J. Rossiter

Region 3 — Regional Director: John E. Haines

Colo.	Rocky Mt. (Denver)	L. L. DeLong	V. F. Vallero
Iowa	Iowa (Des Moines)	R. S. Stover	G. J. Kraai
Kan.	Kansas (Wichita)	H. M. Skalla	T. L. Roberts
Minn.	Minn. (Minneapolis)	J. S. Locke	E. T. Erickson
Mo.	Kansas City	R. M. Spencer	S. C. McCann
Mo.	St. Louis	W. P. Norris	F. E. Ince
Mont.			
Neb.	Nebraska (Omaha)	L. J. Paulsen	C. A. Failor
N. D.			
S. D.			
Wyo.			

Region 4 — Regional Director: A. J. Hess

Ariz.	Arizona (Phoenix)	J. P. Sorensen	W. A. Biddle
Calif.	Golden Gate (S. F.)	J. I. Sprott	W. F. Farmer
Calif.	Sacramento	V. W. Thornburg	
Calif.	So. Calif. (L. A.)	J. L. McCullough	H. F. Ulovec
Idaho			
Nevada			
Ore.	Oregon (Portland)	W. R. Norte	Dick Blankenship
Utah	Utah (Salt Lake City)	W. L. Stuewe	G. E. Wright, Jr.
Wash.	Pac. N.W. (Seattle)	L. F. Christofferson	E. W. Triol
Wash.	Inland Emp. (Spokane)	Max Tonn	F. W. Jenkinson

Region 5 — Regional Director: C. B. Gamble

Ala.			
Fla.			
Ga.	Atlanta	F. W. Bull	J. A. Marshall
Ky.	Bluegrass (Louisville)	W. M. Pace	W. J. Killian
La.	Delta (New Orleans)	J. H. Maloney	I. M. Richardson
La.	Baton Rouge	L. F. Naylor, Jr.	C. S. Woodruff
Md.	Baltimore	L. I. Morris	W. G. Robertson, Jr.
Miss.	Miss. (Jackson)	B. L. Palmer	Burt Lomax, Jr.
N. C.	No. Piedmont (Greensboro)	C. E. Amick	C. A. Coler
N. C.	So. Piedmont (Charlotte)	G. C. Garrett	W. P. Wells
S. C.	S. Carolina (Columbia)	R. K. Rouse	J. E. McMurray
Tenn.	Memphis	W. L. Henson	B. H. Bolding
Va.	Virginia (Norfolk)	E. R. Simpson, Jr.	
D. C.	Washington, D. C.	P. R. Achenbach	W. C. Reamy
W. Va.			

Region 6 — Regional Director: D. M. Mills

Ark.	Arkansas (Little Rock)	I. W. Thompson	W. A. Bullard
La.	Shreveport	H. E. Scott	A. L. Jones, Jr.
N. Mex.	N. Mex. (Albuquerque)	J. K. James	
Okla.	N. East. Okla. (Tulsa)	C. H. Dollmeyer	J. D. Ryan
Okla.	Okla. (Oklahoma City)	F. R. Denham	W. R. Johnson
Texas	North Texas (Dallas)	G. H. Meffert	E. T. Gessell
Texas	South Texas (Houston)	A. B. Ulrich, Jr.	J. C. Lewis
Texas	S. W. Texas (San Antonio)	D. T. Kern	M. E. Staley
Texas	West Texas (Lubbock)	L. P. Davidson	R. A. Mixon

Region 7 — Regional Director: John H. Fox

B. C.	British Columbia (Vancouver)	Cornelius Van Booyen	A. C. Martin
Man.	Manitoba (Winnipeg)	A. H. Millar	G. C. Davis
Que.	Montreal	H. G. S. Murray	D. L. Lindsay
Ont.	Ontario (Toronto)	C. T. Bootes	Charles Torry
Ont.	Ottawa Valley (Ottawa)	W. J. Robinson	E. J. Schoenherr
Alta.	No. Alberta (Edmonton)	P. M. Butler	E. K. Cumming

(*Continued from page 150*)

M.D., R. L. Kuehner, P. J. Marschall, L. J. Pecora, Sid Robinson, E. F. Snyder, Jr.*, C. L. Taylor, T. L. Willmon, C. P. Yaglou.

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ASHAE Committee on Safety Regulations for Heating, Ventilating and Air Conditioning Systems: G. P. Nachman, Chairman; F. H. Buzzard, H. W. McKenzie, B. F. McLouth, C. H. Randolph.

Committee for Revision of ASHAE Standard Code for Testing and Rating Return Line Low Vacuum Heating Pumps: W. M. Wallace, II, Chairman; H. E. Adams, H. S. Beam, A. H. Church, L. M. Nechine, E. G. Powell, A. O. Roche, Jr., D. W. Whittington.

Joint Committee on Standards for Comfort Air Conditioning: W. L. Fleisher, Chairman; (ASHAE) O. W. Armspach, A. C. Buensod, C. C. Cheyney; (ASME) C. F. Kayan; (ASRE) F. H. Faust, C. F. Holske, S. P. Soling; (ARI) M. M. Lawler, R. A. Gonzalez; Alternate: J. R. Schreiner; (U.S. Public Health Service) W. C. Cooper, M.D.; At Large: M. K. Fahnestock, P. J. Marschall, G. E. May, A. B. Newton; (Medical Profession) R. W. Keeton, M.D., W. J. McConnell, M.D.

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Building: A. J. Offner, Chairman; P. B. Gordon, M. F. Blankin, M. W. Bishop, T. H. Urdahl.

Exposition: E. N. McDonnell, Chairman; John E. Haines, L. N. Hunter.

Honors and Awards: E. R. Queer, Chairman; John E. Haines, R. A. Sherman, B. H. Jennings, Ex Officio.

Long-Range Planning: John Everetts, Jr., L. N. Hunter (three years); John E. Haines†, E. L. Crosby (two years); W. A. Grant, J. Donald Kroeker (one year).

NRC—National Academy of Sciences, Div. of Engrg.: L. E. Seeley.

Nuclear Energy Engineering: R. A. Sherman, Chairman; W. F. Friend, W. A. Grant, L. N. Hunter, B. H. Jennings (Committee on Research).

Guide Advisory: C. E. Price, Chairman; R. E. Cherne, J. C. Fitts, P. B. Gordon.

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*Member of Committee on Research.

†Temporary Chairman.

ASHAE — OFFICERS OF CHAPTERS AND BRANCHES

(63 Chapters: 1 Special Branch; 6 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

ARIZONA

Arizona: 1953. Hdqrs., Phoenix. Meets, 1st Mon. PRES, J. B. Hoaglund, 1923 W. Osborn Rd. SECY, F. W. Gabbard, 111 East 14th St., Tempe.

ARKANSAS

Arkansas: 1952. Hdqrs., Little Rock. Meets, 3rd Tues. PRES, J. W. Thompson, 900 Center St. SECY, K. A. Pettit, 904 Wallace Bldg.

CALIFORNIA

Golden Gate: 1937. Hdqrs., San Francisco. Meets, 1st Thurs. PRES, F. K. Crouch, 906 Cerrito St., Albany (6). SECY, J. B. Smith, 1129 Folsom St.

Sacramento Valley: 1952. Hdqrs., Sacramento. Meets, 1st Wed. PRES, R. A. Sarro, 5412 Argo Way (21). SECY, M. J. Delavan, 405 Meister Way (19).

Southern California: 1930. Hdqrs., Los Angeles. Meets, 1st Tues. PRES, H. P. Ulovec, 3866 Olympiad Dr. (43). SECY, A. Z. Levine, 239 S. Oxford Ave. (4).

COLORADO

Rocky Mountain: 1944. Hdqrs., Denver. Meets, 1st Wed. PRES, A. S. Widdowfield, 1925 Blake St. (2). SECY, R. T. Beck, 1304 Cherokee St. (4).

CONNECTICUT

Connecticut: 1940. Hdqrs., New Haven. Meets, 3rd Thurs. PRES, Walter Heywood, 1007 Farmington Ave., West Hartford. SECY, R. B. Cahoon, 1326 Whalley Ave. (15).

DISTRICT OF COLUMBIA

Washington, D.C.: 1935. Hdqrs., Washington, D.C. Meets, 2nd Wed. PRES, J. R. Broome, 4926 Wisconsin Ave. (16). SECY, J. W. Morgan, 2117 M Street, N.W.

GEORGIA

Atlanta: 1937. Hdqrs., Atlanta. Meets, 2nd Mon. PRES, F. W. Bull, 1205 Spring St., N.W. SECY, J. S. Edgar, 2015 Peachtree Rd., N. W.

ILLINOIS

Illinois: 1906. Hdqrs., Chicago. Meets, 2nd Mon. PRES, H. G. Gragg, 228 N. LaSalle St. (1). SECY, Herbert Kreisman, 117 N. Desplaines St. (6).

INDIANA

Indiana: 1943. Hdqrs., Indianapolis. Meets, 4th Tues. PRES, A. O. Roche, Jr., 3950 Broadway (5). SECY, W. F. Currise, 619 Architects & Builders Bldg. (4).

IOWA

Iowa: 1940. Hdqrs., Des Moines. Meets, 2nd Tues. PRES, G. J. Kraai, 907 Sixth Ave. (14). SECY, W. A. Schworm, Physical Plant Dept., Iowa State College, Ames.

KANSAS

Kansas: 1951. Hdqrs., Wichita. Meets, Tues. after 1st Mon. PRES, A. B. Newton, 3511 Elmwood Dr. (17). SECY, T. L. Roberts, 2008 S. Parkwood Lane (16).

KENTUCKY

Bluegrass: 1954. Hdqrs., Louisville. Meets, 2nd Mon. PRES, W. J. Killian, 215 Central Ave. (8). SECY, A. E. Handmaker, 500 Bergman Ave. (8).

LOUISIANA

Baton Rouge: 1955. Hdqrs., Baton Rouge. Meets, 3rd Wed. PRES, J. F. Naylor, Jr., 5363 Greenwell Springs Rd., P.O. Box 4688 Audubon Station. SECY, W. J. Le Blanc, 3185 Government St.

Delta: 1939. Hdqrs., New Orleans. Meets, 3rd Tues. PRES, H. N. Stall, 840 Baronne St. (12). SECY, O. F. Schully, 635 Commercial Pl.

Shreveport: 1948. Hdqrs., Shreveport. Meets, 3rd Thurs. PRES, R. S. Segall, 848 River Rd. SECY, A. L. Jones, Jr., 753 Gladstone.

MARYLAND

Baltimore: 1949. Hdqrs., Baltimore. Meets, 3rd Wed. PRES, E. J. Morris, 813 N. Calvert St. (2). SECY, E. J. Dull, 1122 N. Charles St. (1).

MASSACHUSETTS

Massachusetts: 1912. Hdqrs., Boston. Meets, 3rd Tues. PRES, G. D. Fife, 79 Milk St. SECY, R. F. Curry, 80 Ripley St., Newton Centre (59).

Western Massachusetts: 1955. Hdqrs., Springfield. PRES, R. E. Crose, 114 Boston Rd. SECY, F. A. Ferraro, 172 Chestnut St.

MICHIGAN

Michigan: 1916. Hdqrs., Detroit. Meets, 1st Mon. after 10th of month. PRES, J. N. Livermore, 2000 Second Ave. (26). SECY, J. B. Olivieri, 37294 Ilene, Mt. Clemens.

Western Michigan: 1931. Hdqrs., Grand Rapids. Meets, 2nd Mon. PRES, F. L. Murray, 482 W. Michigan Ave., Battle Creek. SECY, R. J. Waalkes, 500 E. 8th St., Holland.

MINNESOTA

Minnesota: 1918. Hdqrs., Minneapolis. Meets, 1st Mon. PRES, E. T. Erickson, 500 Investors Bldg. (2). SECY, J. H. Jester, 621 E. Hennepin Ave.

MISSISSIPPI

Mississippi: 1953. Hdqrs., Jackson. Meets, 4th Mon. PRES, J. W. Doggett, Jr., 254 Kimbrough Dr. SECY, D. F. Ingram, 408 W. Fortification St.

MISSOURI

Kansas City: 1917. Hdqrs., Kansas City. Meets, 1st Mon. PRES, R. M. Spencer, 1510 Main St. SECY, J. E. Miller, 5830 Outlook, Mission, Kan.

St. Louis: 1918. Hdqrs., St. Louis. Meets, 2nd Tues. PRES, E. T. Clucas, 4354 Olive St. SECY, N. J. Hubbuch, Jr., 7020 Cornell, University City (5).

NEBRASKA

Nebraska: 1940. Hdqrs., Omaha. Meets, 2nd Tues. PRES, T. E. Davis, 4303 Dodge St. SECY, C. A. Failer, 1802 Mason St. (2).

NEW JERSEY

North Jersey: 1952. Hdqrs., Newark. Meets, 2nd Tues. PRES, W. C. Kruse, Jr., 183 N. 13th St. (7). SECY, S. H. Nitzberg, P.O. Box 157, Wood-Ridge.

NEW MEXICO

New Mexico: 1954. Hdqrs., Albuquerque. Meets, 3rd Mon. PRES, H. F. Munn, 419 Granite, N.W. SECY, J. K. James, 4462 Avenida del Sol.

NEW YORK

Central New York: 1944. Hdqrs., Syracuse. Meets, 4th Wed. PRES, H. J. Morton, 122 Lincoln Ave. SECY, E. L. Moyer, R. D. 2, Jamesville.

Empire State Capital: 1951. Hdqrs., Albany. Meets, 2nd Wed. PRES, G. G. Davis, 111 S. Church St., Schenectady. SECY, M. E. Waddell, 1623 Central Ave.

New York: 1911. Hdqrs., New York. Meets, 3rd Mon. PRES, J. B. Hewett, 84 Buena Vista Dr., Dobbs Ferry. SECY, Carl H. Flink, 62 Worth St. (13).

Western New York: 1919. Hdqrs., Buffalo. Meets 2nd Mon. PRES, V. N. Harwood, 250 Delaware Ave. (2). SECY, J. F. Bedard, 505 Franklin St.

NORTH CAROLINA

Northern Piedmont: 1952. Hdqrs., Greensboro. Meets, 2nd or 3rd Fri. PRES, L. R. Gorrell, 1412 Chester Rd., Raleigh. SECY, C. E. Amick, 1042 Oakmont Ave.

Southern Piedmont: 1952. Hdqrs., Charlotte. PRES, J. A. Rice, 719 E. Worthington Ave. SECY, E. D. Streng, P.O. Box 4083.

OHIO

Central Ohio: 1944. Hdqrs., Columbus. Meets, 3rd Mon. PRES, W. A. Schoonover, 2901 N. High St. (2). SECY, R. C. Liebert, 623 N. High St. (11).

Cincinnati: 1932. Hdqrs., Cincinnati. Meets, 1st Tues. PRES, R. G. Anderson, 1758 Elmore St. (23). SECY, C. P. Krantz, 2308 W. 8th St. (4).

Miami Valley: 1950. Hdqrs., Dayton. Meets, 1st Wed. PRES, J. B. Rishel, 397 W. 1st St. (2). SECY, R. B. Walcott, 2340 E. River Rd. (9).

Northern Ohio: 1916. Hdqrs., Cleveland. Meets, 2nd Mon. PRES, H. R. Canoyer, 1900 Superior. SECY, R. D. Wilson, 2142 E. 19th St. (15).

Toledo: 1954. Hdqrs., Toledo. PRES, J. F. Guest, 1815 N. 13th St. SECY, Robert Greenwald, 2525 Portsmouth Ave. (13).

OKLAHOMA

Oklahoma: 1935. Hdqrs., Oklahoma City. Meets, 2nd Mon. PRES, F. R. Denham, 320 Oklahoma Natural Bldg. (2). SECY, W. R. Johnson, 120 E. Main.

Northeastern Oklahoma: 1948. Hdqrs., Tulsa. Meets, 2nd Tues. PRES, H. W. Meinholtz, Box 2261. SECY, H. L. Cauvel, 3342 East 41st St.

OREGON

Oregon: 1939. Hdqrs., Portland. Meets, Thurs. after 1st Tues. PRES, W. R. Norte, 2225 N. E. Broadway (12). SECY, G. G. Van Alst, 947 S. E. Market.

PENNSYLVANIA

Philadelphia: 1916. Hdqrs., Philadelphia. Meets, 2nd Thurs. PRES, C. J. Lubking, 3345 W. Hunting Park Ave. (32). SECY, Ludwig Mack, 412 W. Hortter St. (19).

Pittsburgh: 1919. Hdqrs., Pittsburgh. Meets, 3rd Mon. PRES, R. M. Toucey, 223 Fourth Ave. (22). SECY, G. E. Smetak, 1238 Brighton Rd. (23).

SOUTH CAROLINA

South Carolina: 1954. Hdqrs., Columbia. PRES, J. E. McMurray, 1639 Blanding St. SECY, A. L. Blackstone, Jr., 1630 Laurel St.

TENNESSEE

Memphis: 1944. Hdqrs., Memphis. Meets, 3rd Mon. PRES, W. L. Henson, 496 S. Main St. SECY, G. B. Ramsey, Jr., 157 Neil St. (3).

TEXAS

Austin: 1956. Hdqrs., Austin. PRES, B. E. Segall, Jr., 705 N. Lamar. SECY, J. L. Rea, Jr., P.O. Box 5206.

North Texas: 1938. Hdqrs., Dallas. Meets, 3rd Mon. PRES, H. G. Gregerson, 4512 Livingston (5). SECY, Ross Zumwalt, 929 Mercantile Securities Bldg. (1).

South Texas: 1938. Hdqrs., Houston. Meets, 3rd Fri. PRES, F. M. Neil, P.O. Box 13197 (19). SECY, A. B. Ullrich, 2520 Huldy St. (19).

Southwest Texas: 1946. Hdqrs., San Antonio. Meets 3rd Tues. PRES, Boone Crisp, Rt. 2, Box 421. SECY, D. T. Kern, 14 Chandler Bldg. (5).

West Texas: 1953. Hdqrs., Lubbock. Meets, 1st Tues. PRES, J. C. Wharton, P. O. Box 1240. SECY, D. G. Halley, 3608 Ave. A.

UTAH

Utah: 1944. Hdqrs., Salt Lake City. Meets, 3rd Thurs. PRES, W. L. Stuewe, 1472 S. State St. (4). SECY, W. C. Leslie, 307 W. 2nd St.

VIRGINIA

Virginia: 1946. Hdqrs., Norfolk. Meets, 3rd Wed. PRES, C. G. Conaway, Jr., 7454 Hank Ave. (5). SECY, E. R. Simpson, Jr., 720 Guy St.

WASHINGTON

Inland Empire: 1950. Hdqrs., Spokane. Meets, 1st Mon. PRES, Max Tonn, 4021 S. Latawah. SECY, R. D. Nevers, E. 124 Augusta, P.O Box 5026 (21).

Pacific Northwest: 1928. Hdqrs., Seattle. Meets, 2nd Tues. PRES, L. F. Christofferson, 425-1411 Fourth Ave. Bldg. (1). SECY, H. M. Hendrickson, Mech. Engrg. Dept., University of Washington (5).

WISCONSIN

Wisconsin: 1922. Hdqrs., Milwaukee. Meets, 3rd Mon. PRES, I. J. Rossiter, 231 W. Wisconsin Ave. (3). SECY, R. D. Rodwell, 152 W. Wisconsin Ave. (3).

CANADA

British Columbia: 1952. Hdqrs., Vancouver. Meets, 2nd Wed. PRES, D. W. Thomson, 1690 W. Broadway (9). SECY, W. F. Keenan, 54 W. Fifth Ave. (10).

Manitoba: 1935. Hdqrs., Winnipeg. Meets, 4th Thurs. PRES, G. C. Davis, 212 Waverly St. (9). SECY, A. H. Millar, 342 Mandeville St., St. James (12).

Montreal: 1936. Hdqrs., Montreal. Meets, 3rd Mon. PRES, S. R. Plamondon, City Planning Dept., Smoke Control Division, City Hall. SECY, Arthur DeBreyne, 9 St. Denis St., St. Lambert.

Northern Alberta: 1956. Hdqrs., Edmonton. PRES, W. C. Woods, 13908 116 Ave. SECY, E. K. Cumming, 10249 104 St.

Ontario: 1922. Hdqrs., Toronto. Meets, 1st Mon. PRES, C. J. Bootes, 15 Torbarrie Rd., Downsview. SECY, H. R. Roth, 57 Bloor St., W.

Ottawa Valley: 1952. Hdqrs., Ottawa. Meets, 3rd Tues. PRES, E. J. Schoenherr, 32 Clarey Ave. (1). SECY, C. W. Watson, 102 Bank St.

SPECIAL BRANCH

Switzerland: 1952. Hdqrs., Zurich. PRES, Walter Hausler, Erbstrasse 2, Kusnacht. SECY, L. F. de Bruyn, Muhlebachstrasse 172 (8).

STUDENT BRANCHES

North Carolina State College: 1948. Hdqrs., Raleigh. PRES, P. K. Tuggle, 407 Gay St., Kannapolis. SECY, G. L. Waitman, P.O. Box 3790, North Carolina State College.

Oregon State College: 1949. Hdqrs., Corvallis. Meets, 1st Wed. after 1st Tues. PRES, P. I. Anderson, 202 N. 10th. SECY, D. W. Strahan, 233 Mall St.

Purdue University: 1948. Hdqrs., W. Lafayette, Ind. PRES, R. F. Puncochar, School of Mech. Engrg. SECY, G. T. Vail, Jr., School of Mech. Engrg.

Texas A. & M. College: 1946. Hdqrs., College Station. Meets, 2nd and 4th Tues. PRES, D. F. Carroll, Box 6264. SECY, C. W. Farrar, Jr., Rt. 1, Box 339, Bryan.

University of Detroit: 1949. Hdqrs., Detroit. Meets, 1st Tues. PRES, L. J. Hayes, Jr., 16254 Santa Rosa Dr. (21). SECY, E. F. Hoelscher, Jr., 14283 Cherrylawn (38).

University of Toronto: 1951. Hdqrs., Toronto. PRES, C. F. Smale, 347 Kennedy Ave. (9). SECY, T. D. Digel, 204 King St., Weston.

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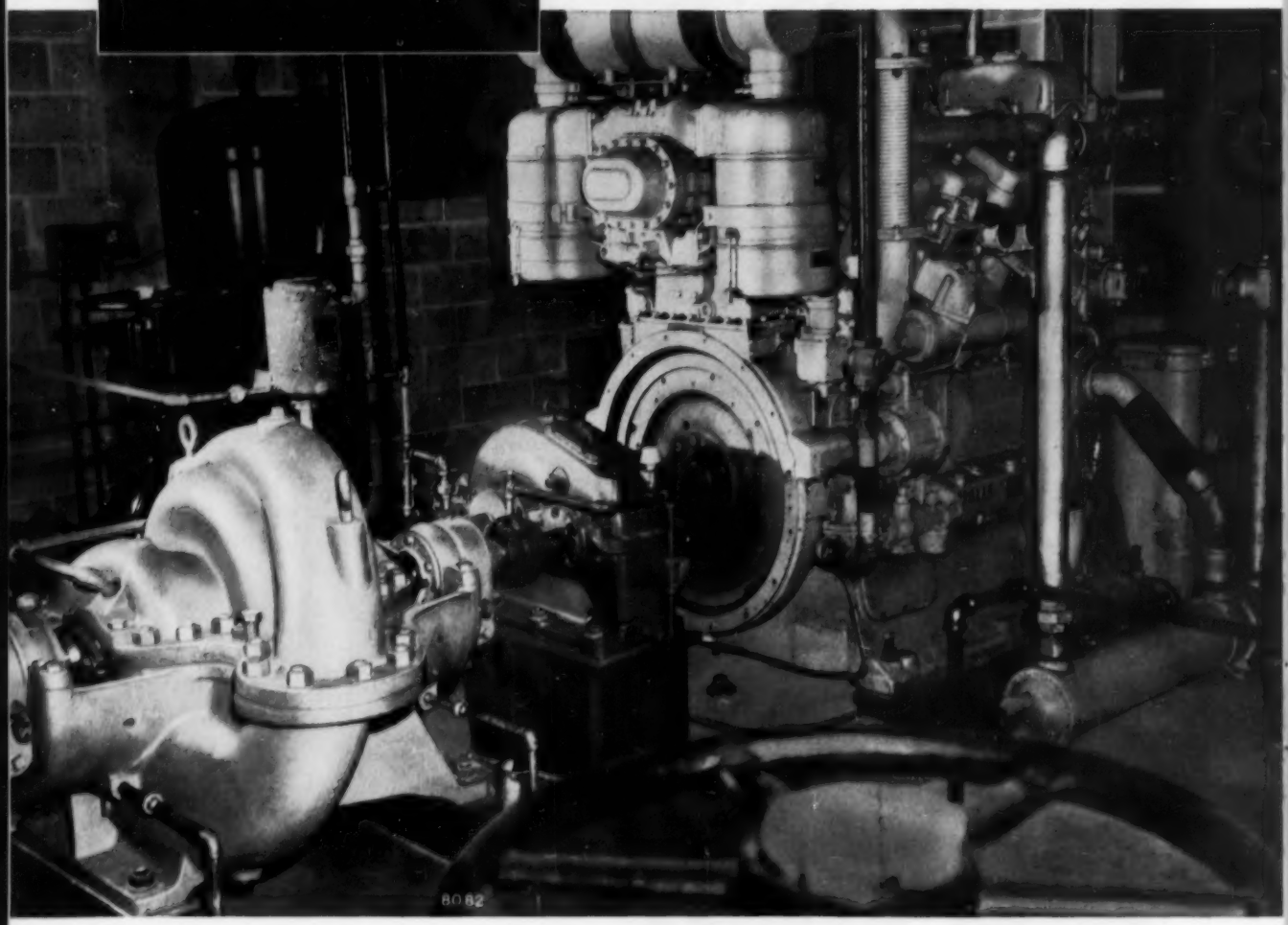


This De Laval two-stage horizontal split-case pump is one of a pair used to boost pressure during peak hours in the Port Washington, New York water works. Taking water from a large underground storage tank, these De Laval units maintain pressure throughout the system. The dependable centrifugal pumps are powered by Caterpillar diesels with speed increasers; they deliver 1500 gpm at 400 feet tdh with 15 feet lift requiring 185 bhp.

De Laval 2IS-2KS pumps are designed with • back-to-back impellers for balanced hydraulic thrust • easily replaceable threaded impeller wearing rings • long-life labyrinth case rings • ring-oiled ball bearings—plus ten other important design features. They are available in sizes from 2 inch to 8 inch discharge, for capacities to 3000 gpm and heads to 750 feet. *Write for Bulletin 1501 giving complete data.*

Consulting Engineer
Angus D. Henderson
Westbury, L. I., N. Y.

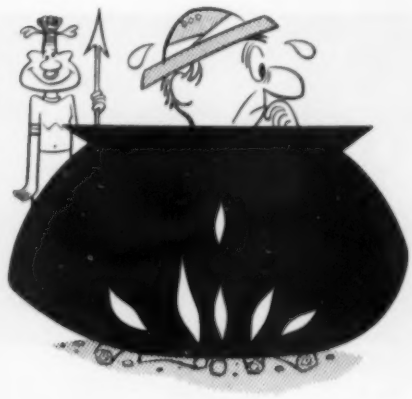
Contractor
D. Fortunato, Inc.
Floral Park, L. I., N. Y.

DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY

871 Nottingham Way, Trenton 2, New Jersey

DL 357



in a stew about stainless steel pipe?

CALL YOUR REPUBLIC ELECTRUNITE DISTRIBUTOR

He'll put an end to your troubles for he has the sizes you need, in the analyses the job calls for. And he's prepared to deliver your order promptly.

You can get Republic ELECTRUNITE® Stainless Steel Pipe in types 304, 304-L, 316, 316-L, 321 and 347—plus other analyses. Continuous welded sizes from ⅛″ I.P.S. through 2″ I.P.S. in A.S.A. schedule 40 S; from ⅛″ I.P.S. through 4″ I.P.S. in schedule 10 S; and from ½″ I.P.S. through 4″ I.P.S. in schedule 5S wall thicknesses. Larger sizes up to 30″ also available. Republic Stainless Steel Tubing is also available in a complete range of sizes and analyses.

There's no problem when it comes to joining the pipe or tubing. Republic ELECTRUNITE Stainless Pipe and Tubing can be welded, threaded or used with compression fittings. To make positive identification easy, Republic ELECTRUNITE is clearly stenciled the full length with the type, heat number and specification. And no matter where it's cut, it's easily identified.

Give your Republic ELECTRUNITE Distributor a chance to demonstrate his service facilities. He's as near as your telephone—and eager to serve you.

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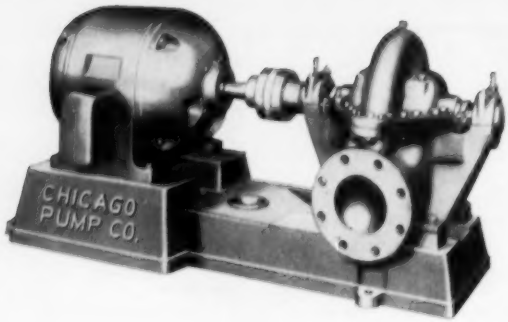
G-1891

FROM *Chicago* TOP QUALITY PUMPS

Engineered for plumbing, heating, and air conditioning systems

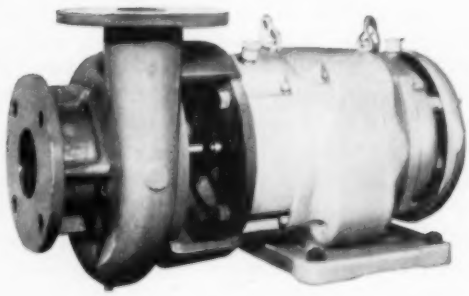


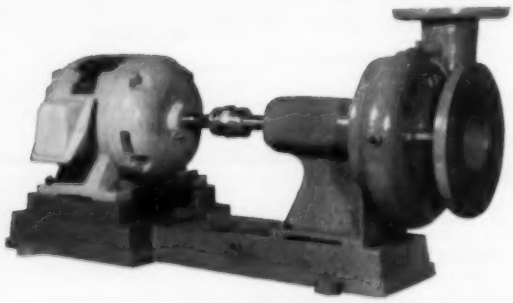
TYPE D DOUBLE SUCTION HORIZONTALLY SPLIT CASE PUMP

A rugged, heavy-duty pump that guarantees long, trouble-free service. The rotating assembly may be inspected without disconnecting the piping. Capacities up to 1900 G.P.M. Heads to 530 Ft. Described in Bulletin 101.

TYPE CC CLOSE COUPLED PUMP

Handles the toughest pumping jobs efficiently and in the least possible space. May be mounted in any position as long as the motor is not lower than the pump. Equipped with leak-proof mechanical seal. Capacities up to 500 G.P.M. Heads to 215 Ft. Described in Bulletin 108.





TYPE FC PEDESTAL MOUNTED FLEXIBLE COUPLED PUMP

Like the CC, all FC pumps are equipped with the most reliable mechanical seal ever built into a pump. Ceramic-faced stationary seat is highly resistant to wear. Accurately lapped surfaces and automatic adjustment for wear assures long life under strenuous service. Described in Bulletin 107.

For trouble-free, "worry-proof," efficient pumping at all times — specify Chicago Pumps. Write for complete information.

fmc **CHICAGO PUMP COMPANY**

Subsidiary of Food Machinery and Chemical Corporation

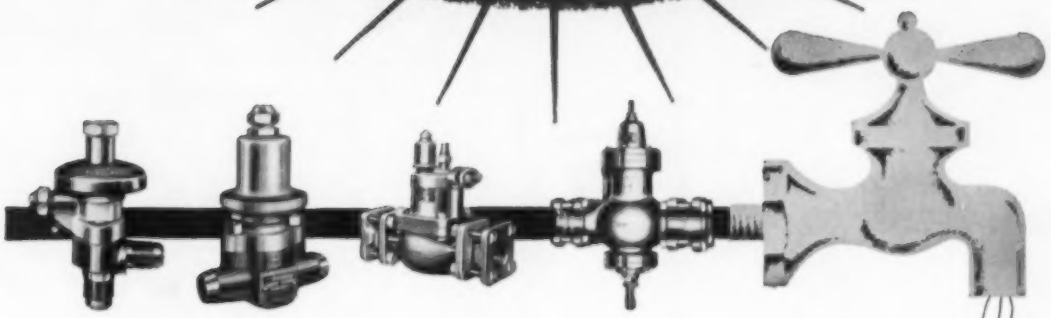
BUILDING PUMP DIVISION

433 DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

Cleado-Vac ®, Sure Return ®, AVC, LVC, Fire House & Circulating Pumps, Pneumatic & Tankless Water Systems, Flush Kleen ®, Sewage Ejectors, Little Giant ® & Non-Clog Bilge Pumps. Pumps for every industrial use.

anti-freezers

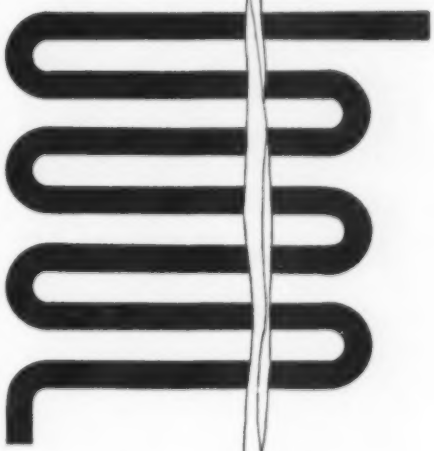
FOR YOUR WATER COOLERS



ALCO evaporator pressure regulators

They maintain constant evaporator pressure under all load conditions. Result: Efficient cooling without freezing—no busted coolers! For any size water cooler from drinking fountains to large industrial jobs.

WRITE FOR BULLETIN 183-54



ENGINEERED FOR SERVICE FOR LIFE

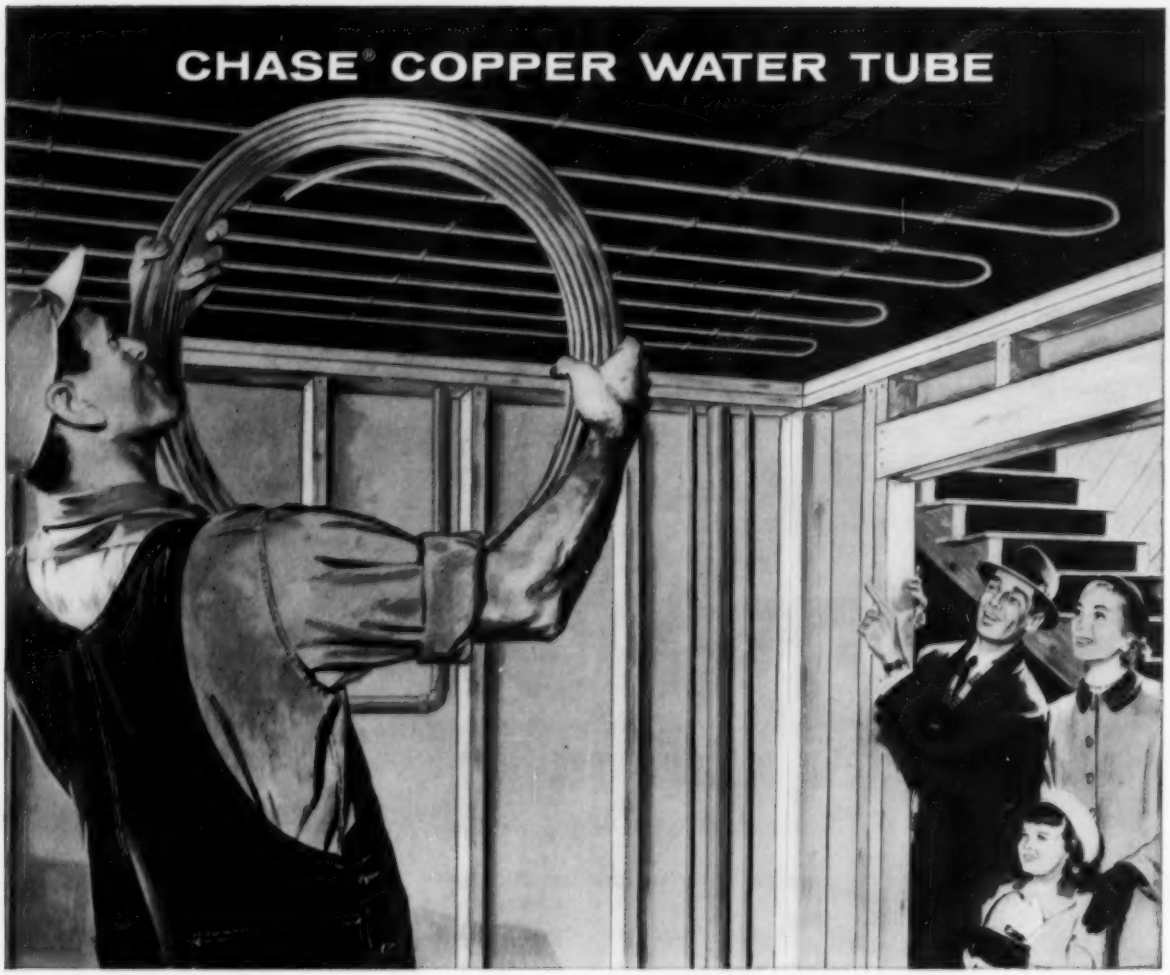
SEE YOUR ALCO WHOLESALER

ALCO VALVE CO.

5811 KINGSLAND AVE., ST. LOUIS 3, MO.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

6316



NO CEILING ON COMFORT HERE !

But, plenty of ceiling on cost!

That's because lightweight, easy-handling Chase copper tube for radiant heating *installs faster!* Perfectly tempered, it easily unrolls into position on ceiling or floor. Comes in long 60 and 100-foot lengths that result in fewer joints. Connections are quickly made with simple soldering techniques.

Even the rugged carton for Chase copper water tube is designed to speed handling...save time! It's color-coded for easy identification of type and size. Has a center hole big enough for a firm grip. Can be stacked, rolled or carried with ease!

Proof that Chase copper water tube cuts installation time is the fact that it is being used in many of the largest housing developments where over-all costs *must be low!*

If it's radiant heating, be sure the system is made with Chase copper tube and solder-joint fittings.

Chase

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass, Copper and Stainless Steel

Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

74 TONS *of GILSULATE were poured around 1500-foot steam line.*

ONLY 5 MEN *(unskilled) were needed to do the job: two in the trench and 3 above.*

Western Carolina College Chooses GILSULATE® for New Steam Installation

On its modern campus at Cullowhee, N. C., Western Carolina College recently poured 66 tons of type B and 8 tons of type A GILSULATE on a 1500-foot steam line installation. This brought to more than 1200 tons the volume of GILSULATE used by North Carolina institutions, schools and colleges during 1955—enough to fill 40 railroad cars, or a ditch one yard wide by one yard deep and 10 city blocks long!

The installation consists of a 6″ steam and a 2″ condensate piping system. During pouring, only 2 men were required in the trench and 3 men above to open the bags and pour.

No other insulation for hot underground pipes can match this low-cost performance—just as no other insulation can match GILSULATE for *permanent* protection of piping systems. No wonder more and more engineers, architects and contractors are *specifying* GILSULATE for their hot underground piping work!

Whatever the type of job you have in mind—airport, school, utility, institution, factory, railroad—it will pay you to investigate the unusual features of this easily-installed, dependable, low-cost system. Use the coupon below or see your local GILSULATE dealer.

FACTS ABOUT GILSULATE

1. *EASY TO USE*—just pour and tamp …pipe heat does the rest.
2. *FORMS 3 ZONES* of protection against heat loss and all hazards commonly encountered by hot buried pipes.
3. *NEEDS NO HOUSING OR MECHANICAL SHEATHS:* no mixing, special handling or equipment.
4. *ONLY NEEDS NORMAL PIPE SPACING:* for multiple pipe or cramped conditions.
5. *THREE TYPES AVAILABLE:*
   Type A for 220°-300° F. temp. range
   Type B for 300°-385° F. temp. range
   Type C for 385°-520° F. temp. range

UNGRADED DITCH. *Concrete pads were located at 10-foot intervals and 4″ transite pipe supports placed on top of them.*

THE TRIPLE-ZONE INSULATION SYSTEM FOR LIFE-TIME PROTECTION OF HOT UNDERGROUND PIPES

GILSULATE®

AMERICAN GILSONITE COMPANY, SALT LAKE CITY 1, UTAH
Affiliate of Barber Oil Corp. & Standard Oil Co. of California

American Gilsonite Co. 1145 East Jersey St. Elizabeth 4, N. J.
134-B West Broadway Salt Lake City 1, Utah OR The Agents Building 3537 Lee Road, Cleveland, O.

Send me more information on GILSULATE

NAME .....

TITLE .....

COMPANY .....

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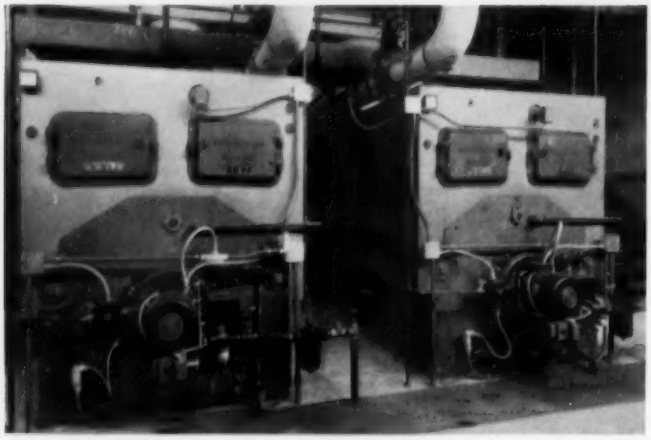
HPA

The boiler that best meets every *School Requirement*



Installation of Weil-McLain "HR" Boilers equipped with rotary oil burners in St. Mathews High School, Philadelphia, Pa.

Here's why the Weil-McLain "HR" Series Cast Iron Boiler for horizontal rotary oil burners is the ideal selection for schools...*or any other large installation!*

Low operating cost. Designed specifically to fully develop the heating economy obtainable with low-cost heavy oils.

Saves in construction cost. The "HR" can be installed in a smaller boiler room—no space needed for pulling boiler tubes—less head room required.

Permits future building expansion. Extra capacity can be provided by adding sections. "HR" sections pass through an ordinary door.

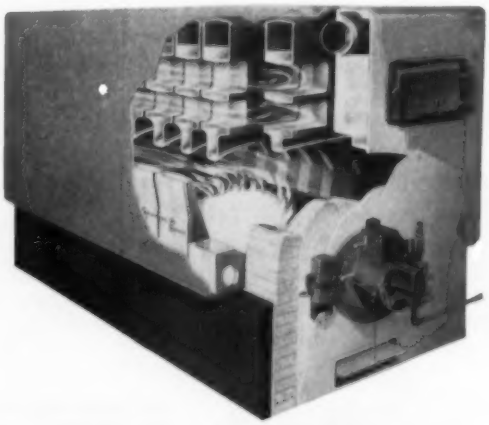
Inexpensive maintenance. Easily cleaned for top efficiency. Repairs in general are minor because cast iron boilers are immune to usual causes of breakdown.

Longer lived. Cast iron is more resistant to corrosive effects of flue gas. The tough outer skin of "HR" Boiler sections is left on to protect against rusting—no face grinding.

Why the WEIL-McLAIN "HR" BOILER MOST EFFICIENTLY BURNS HEAVY OILS

The "HR" Boiler was designed in cooperation with leading manufacturers of horizontal rotary oil burners. The features below show why it provides the most favorable burning conditions and efficiently absorbs the intense heat of rotary burner flames.

1. Large firebox volume develops better combustion conditions and maximum radiant heat transmission.
2. Curved primary heating surface extends from crown sheet, greatly increasing area directly above the fire.
3. Balanced gas travel through the flueways assures equal distribution of heat to all secondary heating surfaces.
4. Generous waterways permit rapid, efficient water circulation through boiler.
5. Large steam space assures rapid generation of dry steam.
6. Rugged cast iron construction for durability and trouble-free operation.
7. Individual short draw rods simplify assembly and contribute to longer boiler life.
8. Special steel front plate and section simplify installation of rotary burner.
9. High base makes more combustion space available—eliminates high brick foundation.



WEIL-McLAIN BOILERS · RADIATORS

WEIL-McLAIN

"HR" SERIES BOILERS

FOR HORIZONTAL ROTARY OIL BURNERS

WEIL-McLAIN COMPANY · Dept. AA86 · Michigan City, Indiana

genetron®
Super-Dry Refrigerants

Jenni Genetron Says: **"No matter where you are there's a genetron wholesaler near you!"**

Coast-to-coast, America's leading Refrigeration and Air Conditioning Wholesalers feature *Genetron* Super-Dry Refrigerants. There's one as near to you as your telephone ready to supply you with complete stocks of *Genetron* Refrigerants and with up-to-the-minute data on their uses.

Remember—*Genetron* Refrigerants are super-dry! Their moisture content is exceptionally low; their overall purity extremely high. They meet the industry's most exacting refrigerant specifications . . . are freely interchangeable with comparable fluorinated hydrocarbon refrigerants produced by any other manufacturer. Follow the industry-wide trend to Super-Dry *Genetron* Refrigerants. Always ask for *Genetron!*

genetron 11 ORANGE LABEL
TRICHLOROMONOFLUOROMETHANE

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genetron 141 GREEN LABEL
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genetron 226 PURPLE LABEL
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genetron 320 DARK BLUE LABEL
DICHLOROTETRAFLUOROETHANE

Valuable Folder!
Ask your wholesaler for special folder on *Genetron* Super-Dry Refrigerants. Contains pressure- temperature charts and other helpful information.

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ALLIED CHEMICAL & DYE CORPORATION
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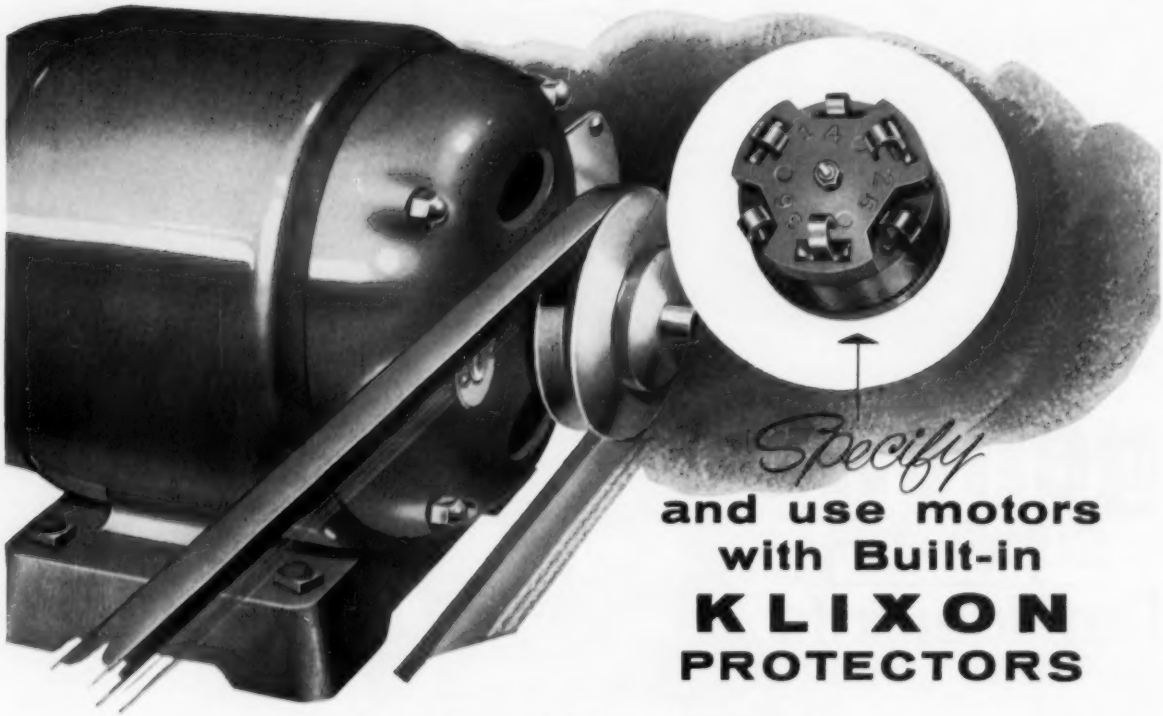
It's Here...

A Single Built-in KLIXON Protector Gives Full Protection Engineered into

3-Phase Motors



Specify
and use motors with Built-in
KLIXON PROTECTORS

★ Eliminate Motor Burnouts
★ Reduce Production Down Time ★ Simplify Motor Controls
★ Minimize Motor Repairs and Replacements
★ Assure Maximum Motor Capacity Under Any Conditions

Over-temperature protection is vital to dependable 3-phase motor performance. Now complete protection for 3-phase motors can be yours with a single built-in Klixon Protector.

Now you can get the same dependable protection in 3-phase motors that manufacturers have for years built into single phase motors. This inherent protection is now available to manufacturers of 3-phase motors covering a horsepower range from fractional up through 7½ hp. (600V.)

KLIXON Protectors Prevent Overheating Caused By:
1. Prolonged overloads
2. Single phasing
3. Stalling
4. Failure to start
5. Lack of ventilation
6. Increase in ambient temperatures
7. Plugging or reversing duty

Specify and use motors with Klixon Inherent Protectors. Write for Bulletin MOPR1 for details of inherent motor protection.

KLIXON®
METALS & CONTROLS CORPORATION
SPENCER THERMOSTAT DIVISION
3408 FOREST STREET, ATTLEBORO, MASS.

One of two new hangars for jet planes of the Strategic Air Command's 813th Air Division, Pinecastle Air Force Base, Orlando, Fla. Beth-Co-Weld Steel Pipe, used in sprinkler systems, was installed by Moore Pipe & Sprinkler Co., Jacksonville.

Air Force Hangar in Florida . . .

Hospital in Connecticut . . .

Both Use Beth-Co-Weld

Beth-Co-Weld Steel Pipe is used for plumbing and heating lines in new Fairfield State Hospital, Newtown, Conn. *Contractor:* Buckingham Routh Co., New Haven; *Jobber:* Parsons Bros., Inc., Bridgeport.

Whether it's for general-purpose piping, or for sprinkler systems, you'll find that Beth-Co-Weld is good, sound, easy-working steel pipe.

Beth-Co-Weld is easy to cut, thread and weld, and is a dependable performer as well, because it is made from a good grade of steel by the continuous-weld process.

Most jobbers stock Beth-Co-Weld Steel Pipe in all sizes from ½ in. to 4 in., standard-weight, and from ½ in. to 3 in., extra-strong weight, in 21-ft lengths, plus or minus 1 in., and in random lengths.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

65-year test

directs choice of valves for new Rochester home of

WILMOT CASTLE COMPANY

Architect: Carl L. Traver *General Contractor:* John B. Pike & Son, Inc.
Heating Contractor: Howe & Bassett Co. *Plumbing Contractor:* Bareham Contracting Co.

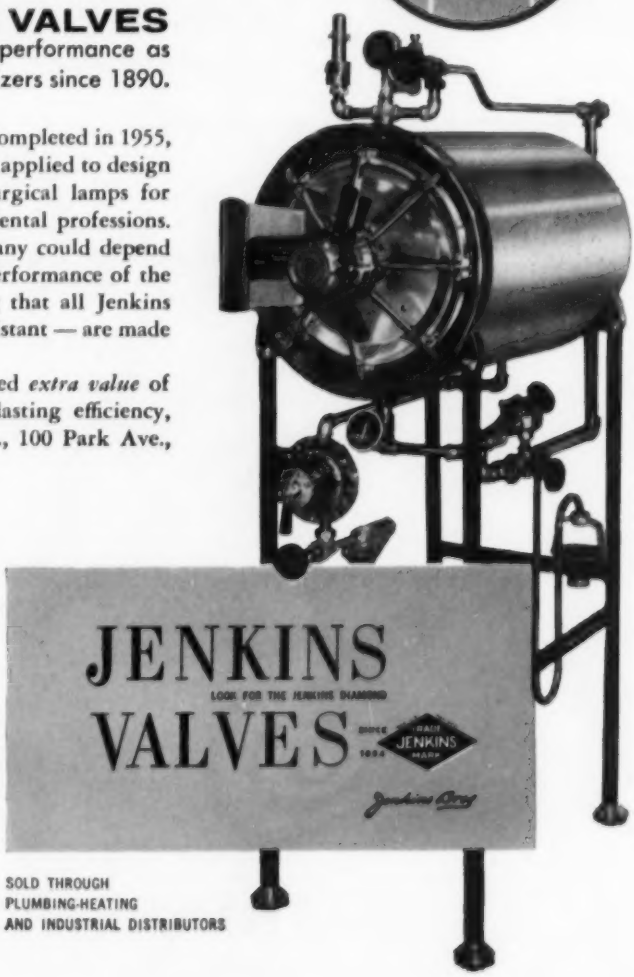
JENKINS VALVES

qualify on long record of reliable performance as standard equipment on Castle Sterilizers since 1890.

The Wilmot Castle plant at Rochester, N. Y., completed in 1955, was planned with the same exacting standards applied to design of Castle's fine products — sterilizers and surgical lamps for hospitals, laboratories, and the medical and dental professions.

In selecting valves for the plant, the company could depend on their long experience with the faultless performance of the valves used on Castle Sterilizers, recognizing that all Jenkins Valves — bronze, iron, steel, and corrosion resistant — are made to the same high standards.

For *both plant and product,* the time-proved *extra value* of Jenkins Valves is dependable assurance of lasting efficiency, safety, and operating economy. Jenkins Bros., 100 Park Ave., New York 17.

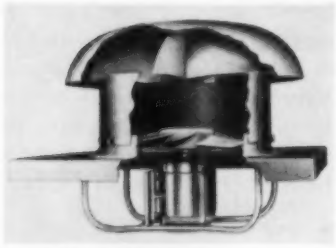


THE HOSPITAL LABORATORY AUTOCLAVE illustrated is one of the many types of Castle Sterilizers used in hospitals and laboratories, and shows typical use of Jenkins Valves on the steam, water supply, and drain lines. Valves are renewable composition disc type, and have special heat-resistant, non-staining Bakelite handles, with each valve's function moulded in the top. Jenkins Valves provide the sturdy construction, safety, and good appearance required. They also permit quick, easy maintenance, since the renewable discs, made also by Jenkins Bros., are available anywhere from Jenkins Distributors.

SOLD THROUGH
PLUMBING-HEATING
AND INDUSTRIAL DISTRIBUTORS

EQUIPMENT DEVELOPMENTS . . .

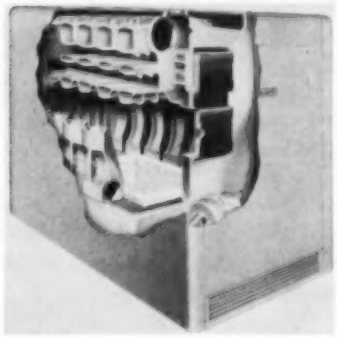
For reviews of Recent Trade Literature see Page 212



Roof Ventilator . . .

. . .with hollow, die-formed airfoil fan blades—*Detroit Blower Corp., Dept. HPAC, 9867 Pacific Ave., Franklin Park, Ill.*

Exhaust air leaving axial wheel spins upward where caught by special guide vanes, which are integral part of head, and spun out into atmosphere for silent ventilating, says company. Motor in square-cut mounting base provides lower silhouette. Blade diameters are 9 to 48 in. Outputs range 350 to 34,430 cfm of fumes, smoke, dust.



Boiler . . .

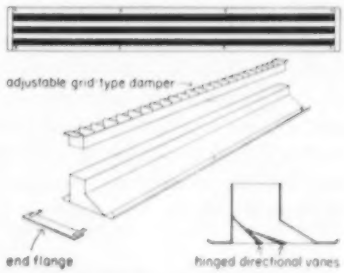
. . .with self-regulating, turn-around flue gas travel—*Weil-McLain Co., Dept. HPAC, Michigan City, Ind.*

Breaks hot gases leaving combustion chamber into small streams contacting cooler sides of firebox. Furnished with aluminum alloy housing. Nozzle adjustment made to forward, backward, lateral positions while burner is operating. Asbestos rope, grooved putty strip allows expansion, contraction. Available for hot water, steam. Has I=B=R ratings 161,000 to 331,000 Btu. For small commercial uses.

Portable Psychrometer . . .

. . .for determining relative humidity, designed to government specifications—*Friez Instrument Div., Bendix Aviation Corp., Dept. HPAC, Taylor Ave., Towson, Baltimore 4.*

"Psychron" consists of matched wet, dry bulb thermometer assembly ventilated by small fan coupled to motor. Powered by three flashlight batteries. Is said to be immune from radiation effects of sun. Has built-in thermometer illumination system.



Air Diffusers . . .

. . .for interiors requiring linear type of outlet—*Connor Engineering Corp., Dept. HPAC, Danbury, Conn.*

Adjustable grid-type damper regulates air volume over diffuser length. Hinged extruded aluminum vanes can be positioned for any angle of air discharge, says company. Available in two models; "KSL-1" for single air stream discharge in 3½, 6 in. widths; "KSL-2" for multi-directional discharge, greater capacity in 12 in. width. Both made in 2, 3, 4 and 6 ft modules. Capacities range 50 to 300 cfm per ft of length, depending on model, space to be served.

Submersible Pump . . .

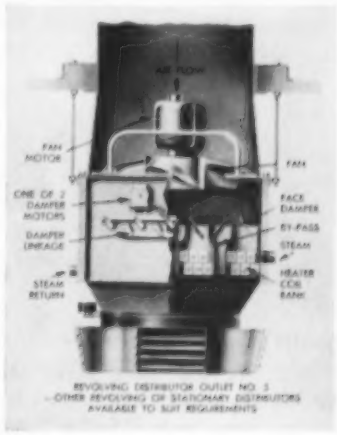
. . .with built-in check valve, air lock eliminator, control, cord and cap—*Kenco Pump Div., American Crucible Products Co., Dept. HPAC, 1305 Oberlin Ave., Lorain, Ohio.*

Designed for automatic intermittent operation, continuous submerged duty. Model "140" can circulate liquids in closed systems. Capacities range 1100 to 2600 gph.

Cooling Towers . . .

. . .designed for outdoor, indoor use—*Larkin Coils, Inc., Dept. HPAC, 519 Memorial Drive., S. E., Atlanta 1, Ga.*

"Hydro-Miser" units have wetted surfaces of redwood with nailless interlocked construction, bolted panels for easy removal, says company. Two and 3 ton models with fan have direct drive, totally enclosed motors; others are belt driven, with drip-proof motors. Eleven models available in sizes 2 to 50 ton capacity; seven centrifugal-blower models from two to 20 tons.



Heater . . .

. . .designed for replacement of air exhausted in manufacturing processes—*L. J. Wing Mfg. Co., Dept. HPAC, 140 Vreeland Mills Rd., Linden, N.J.*

"FAS" unit consists of motor, fan; heater section comprising alternate heating, bypass passages, dis-

EQUIPMENT DEVELOPMENTS

Continued

tributing outlet. Air brought in through bypasses is not heated. Available in two types: vertical flow, horizontal flow.

Air Vent . . .

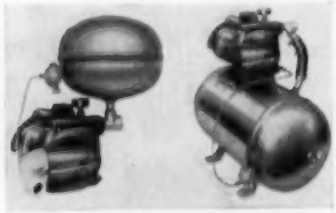
. . .designed to require no tools for venting—*Ra-Rich Mfg. Corp., Dept. HPAC, Holtsville, N. Y.*

No. "1W" engineered so that valves can be vented manually, says company. For use in hot water heating systems, convectors, free standing, baseboard and panel radiation.

Hydrazine . . .

. . .for boiler feedwater treatment—*Olin Mathieson Chemical Corp., Dept. HPAC,* 460 *Park Ave., New York* 22.

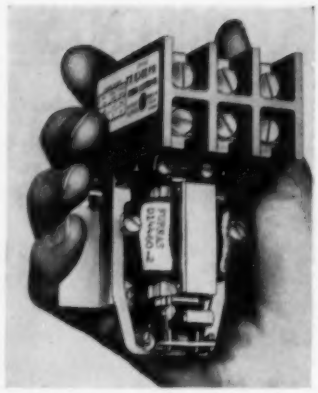
Product is 35 percent water solution of hydrazine, an effective agent for removal of dissolved oxygen from water. "Scav-Ox" is stable, nonflammable; has no flash point, fire point, says company.



Pump . . .

. . .with stainless steel shaft, mechanical shaft seal, bronze impeller, cast-iron pump case—*Peerless Pump Div., Food Machinery and Chemical Corp., Dept. HPAC,* 301 *West Ave.* 26, *Los Angeles* 31.

Convertible jet unit is said to pump up to 1000 gph in shallow well system, up to 840 gph when converted to deep well operation. Available in sizes 1/3, ½ and ¾ hp; 4 to 42 gal tanks.



Controls . . .

. . .for air conditioning, refrigeration—*Furnas Electric Co., Dept. HPAC,* 1041 *W. McKee St., Batavia, Ill.*

Ampere size manufactured to match single, polyphase starter requirements for current rated motors through 550 volts. Features include: silver cadmium oxide contacts, magnets require less wattage, each pole carries full current, resistance to fungus and arc erosion, says company. In sizes 20, 30, 35, 50 amperes.

Roof Ventilator . . .

. . .with low contour design—*Swartwout Co., Dept. HPAC,* 18511 *Euclid Ave., Cleveland* 12.

Cited features: is weatherproof, drainage runs directly to roof on both sides, low height assures less wind resistance. May be installed in single units or in continuous runs any length desired.

Panel Coils . . .

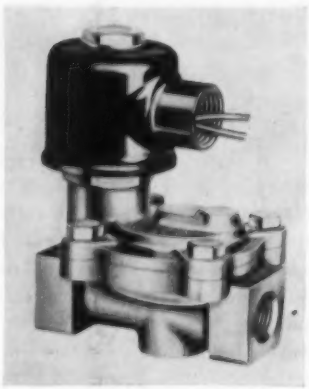
. . .with new design for inside, outside heating of drums, tanks—*Dean Thermo-Panel Coil Div., Dean Products, Inc., Dept. HPAC,* 616 *Franklin Ave., Brooklyn* 38.

Coil consists of two sheets of metal with suitable embossing which are welded to form necessary flow channels. Recommended by company for steam or other heating, also for cooling.

Electrode . . .

. . .designed for a-c, d-c operation—*Hobart Brothers Co., Dept. HPAC, Hobart Square, Troy, Ohio.*

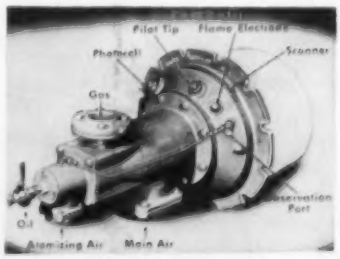
All-position "Hobart 212" produces little spatter even when using amperages higher than normal for this type of electrode, says company. Designed for fast production, fabrication, maintenance welding. Recommended by manufacturer for use where fit up is poor. In sizes ⅛, 5/32, 3/16, 7/32, 5/16 in.



Solenoid Valve . . .

. . .designed to meet need for "off the shelf" multi-purpose valve—*General Controls Co., Dept. HPAC, Glendale, Calif.*

Because of diaphragm action, full flow ports, "K-181" is capable of handling large capacities with minimum pressure drop, says company. Features forged brass body, packless construction, tight shutoff. Available in ⅜, ½ in. sizes. In two models: standard, hot water.



Dual Fuel Burner . . .

. . .with 6 in. air pipe connection—*North American Mfg. Co., Dept. HPAC,* 4455 *E. 71st St., Cleveland* 5.

At 16 psi air pressure burner's capacity is 4,850,000 Btu per hr, says company. Designed to produce stable

THIS HAND BEATS ALMOST ANY AIR OR FUME EXHAUST PROBLEM

Beat noise . . . with the DeBothezat *Centrifugal* Roof Ventilator. Runs at low tip speeds, moves large volumes of air efficiently against static pressure. Low in silhouette, blends well with modern architecture.

Beat oil and dust-laden air . . . with the *Vertical Discharge* Roof Ventilator. Exhausts air straight up at high velocity. Keeps harmful residue from attacking the roof.

Beat most industrial air removal problems . . . with the *Power-Flow* Roof Ventilator. Ruggedly built unit in an aerodynamically correct, weather-proof housing.

Beat hot, flammable, corrosive fumes . . . with the *Bifurcator*®. Fumes bypass the motor (located in an isolated chamber) which always stays clean, cool and accessible.

Send for bulletins on DeBothezat fans for your problems.

De Bothezat FANS
A DIVISION OF
American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

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DeBOTHEZAT FANS DIVISION, Dept. HP-856
American Machine and Metals, Inc.
East Moline, Illinois

Please send me a complete catalog on each of the following DeBothezat fans:

- ☐ Centrifugal Roof Ventilator
- ☐ Vertical Discharge Roof Ventilator
- ☐ Power-Flow Roof Ventilator
- ☐ Bifurcator

COMPANY _____

ADDRESS _____

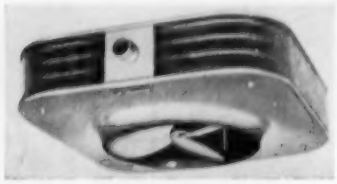
CITY _____ ZONE _____ STATE _____

ATTENTION MR. _____

EQUIPMENT DEVELOPMENTS

Continued

fire on light-up without need for constant pilot, says company. Series "214" furnished with observation port, complete with tubing and fittings to introduce atomizing air into mounting to keep port clear for observation.



Unit Heater . . .

. . .with wrap-around, rectangular heating elements—*John J. Nesbitt, Inc., Dept. HPAC, State Rd. and Rhawn St., Philadelphia* 36.

Designed to perform with steam or hot water in either vertical, horizontal applications. "Little Giant" offered in 34 models with capacities 34,000 to 684,000 Btu per hr. Wide variety of air deflector attachments available, says company.

Oil, Water Extractors . . .

. . .with automatic drain which opens when air supply is shut off, closes when air supply is turned on —*Binks Mfg. Co., Dept. HPAC,* 3122 *Carroll Ave., Chicago* 12.

Combination of spiral baffles with special absorbent filters in each extractor removes oil, rust, dirt, etc., before it reaches the spray gun, says company. In two models: "AO-125," "AO-124." Air capacity of units is 100 cfm.

Cooling Towers . . .

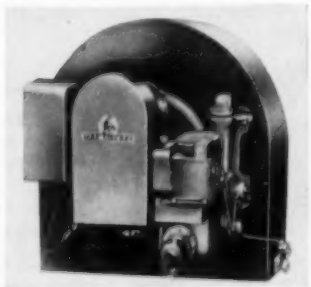
. . .for commercial air conditioning applications—*Master-Bilt Refrigeration Mfg. Co., Dept. HPAC,* 920 *Palm St., St. Louis* 7.

Line has recessed fan venturi, removable redwood decking, propeller-type fan with 440 pitch, v-belt driven, motor pivot-mounted, exterior lubrication fittings, adaptability to indoor, outdoor installation, says company. In 15, 20, 25, 30, 40, 50 ton sizes.

¾ Ton Air Conditioner . . .

. . .with design improvements—*Lewyt Air Conditioner Corp., Dept. HPAC,* 43-22 *Queens St., Long Island City* 1, *N. Y.*

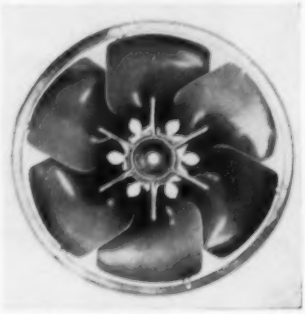
For built-in-wall installation, unit's changes include two motors with overload protector, automatic reset; five adjustable directors to control flow of air, eliminate drafts; allergy-proof aluminum filter that may be cleaned with water, never replaced; six-bladed aluminum condenser fan, slinger ring; twin double blower scroll; knockouts on shell; improved condenser coil; says company.



Gas-Oil Burners . . .

. . .designed to fire with No. 6 or lighter oil—*Iron Fireman Mfg. Co., Dept. HPAC, Cleveland* 11.

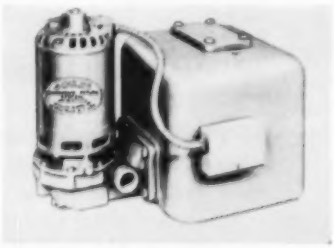
Each model has integral air register. Shipped as separate units. Ring-type gas burner has multiple tubular stainless steel jets threaded into heat-resistant cast iron manifold ring. Capacities range from 1,650,000 to 18,750,000 Btu input. No mechanical changes are necessary for fuel changeover, says company.



Six-Bladed Fan . . .

. . .with reduced axial depth—*Torrington Mfg. Co., Dept. HPAC, Torrington, Conn.*

Developed primarily as condenser fan with slinger ring in room air conditioners. Axial depth of fans in type "C-12-6" series ranges 1 15/16 to 3 5/16 in. Has 12 in. tip diameter. Can be used with either solid or rubber-bushed hub. Available also with four blades.



Condensate Return . . .

. . .pumping units for closed low pressure steam heating systems, process equipment—*Goulds Pumps, Inc., Dept. HPAC, Seneca Falls, N. Y.*

Straight condensate return units, "automatically" return condensate to boiler. Boiler feed condensate return system blends raw makeup water, hot return condensate, injects into boiler to maintain water line at even rate. Available in 7, 14, 40, 60, 100 gal units.

(*Continued on page* 182)

Fit-up is Fast, Easy and Permanent with B&W CROLOY Elbows

THIS end-use required welding fittings resistant to heat and corrosion—*plus* economical fabrication. B&W CROLOY 5 was chosen to meet service requirements. Dimensional accuracy and uniformly beveled ends of B&W Elbows simplified the welding procedure.

CROLOY 5 is one of a complete series of chromium molybdenum alloy steels developed by B&W to meet varying conditions of corrosion and oxidation in elevated pressure service. Further information on CROLOY 5 is available in B&W Bulletin 146.

B&W Alloy Welding Fittings and Flanges reduce fabricating time because they provide positive alignment at joints and are quick and easy to weld. B&W Bulletin 502 gives complete information.

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION • FITTINGS DEPARTMENT
3839 WEST BURNHAM STREET • MILWAUKEE 46, WISCONSIN

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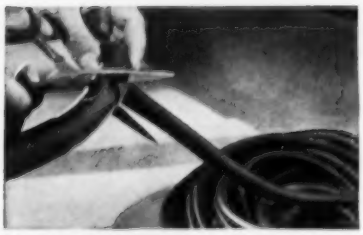
Seamless welding fittings and flanges, seamless and welded tubular products — in carbon, alloy and stainless steels

B.F.Goodrich

How Cell-Tite® solves 2 miles of condensation problems



Supplied in 50 foot rolls, tubing can be custom cut for the job, eliminating waste and reducing costs.

Flexible Cell-Tite tubing is ideal for short, sharp curves of copper tubing. Except for modernizing existing installations, piecing or gluing is unnecessary.

AFTER a recent air conditioning installation that required over 11,000 feet of Spongex Cell-Tite tubing, Mr. Charles Ross, President, Economy Plumbing & Heating Co., Chicago, said:

"Spongex Molded Cell-Tite is in a class by itself as an insulation material on flexible copper tubing. It certainly has solved a long-standing problem. We'd tried everything in the past; some were too slow and sloppy, others too bulky and rigid, and still others were supplied only in 3-foot lengths.

"With Cell-Tite, cutting the tubing to length is no problem at all. We simply use ordinary scissors. We don't have any messy gluing problem. Actually, the most inexperienced workmen can slip this material around a coupling, and achieve a tight fit."

Spongex Cell-Tite is durable rubber with millions of non-interconnecting cells, each acting as a separate insulator. This means Cell-Tite tubing not only protects against moisture condensation in the summer, but also withstands the high temperatures of winter heating.

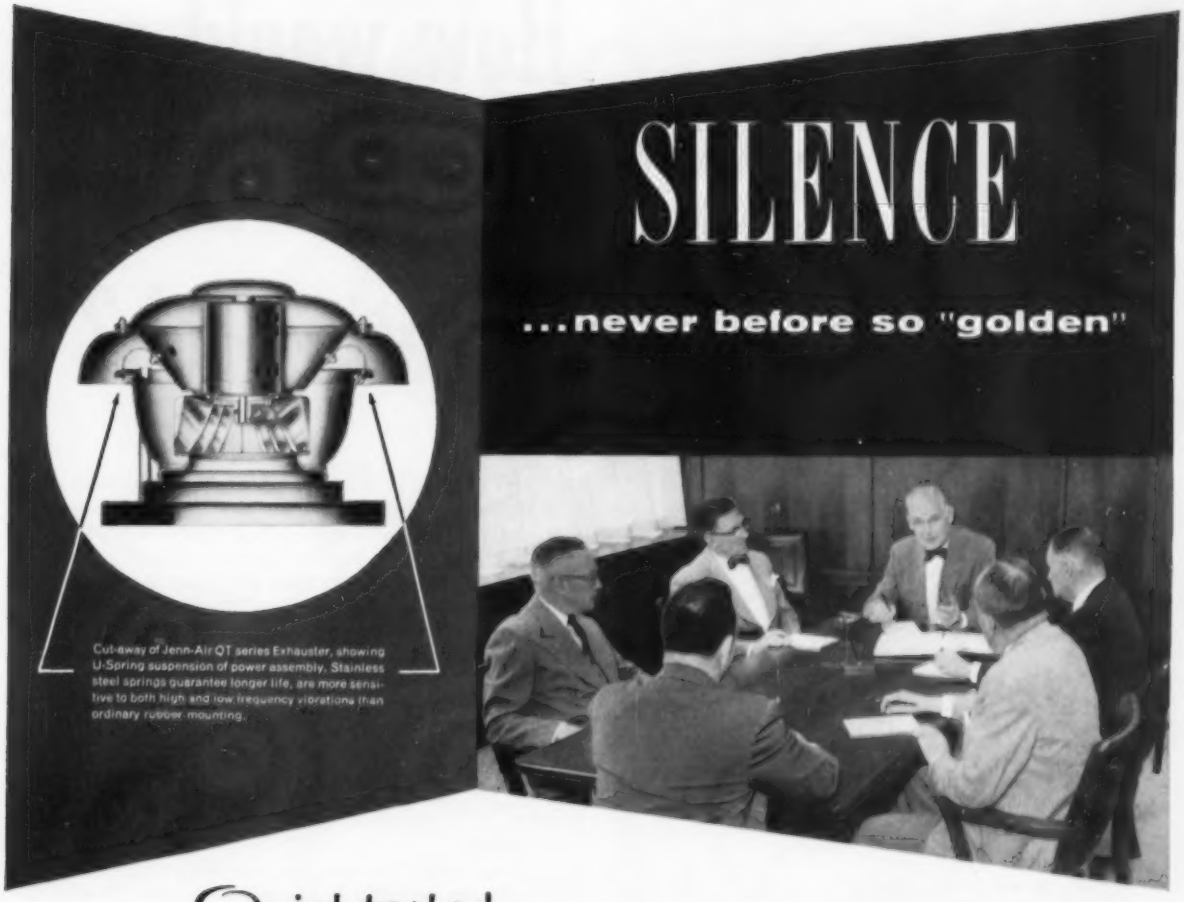
As tubing, Spongex Cell-Tite is made with standard outside diameters of ¾", 1", 1¼", 1½", and can be made 1⅜", 1¾" and 2". Almost any inside diameter is available up to ¼" of the outside diameter in lengths up to fifty feet.

For more technical information write B. F. Goodrich Sponge Products Division, 281 Derby Place, Shelton, Conn.

B.F.Goodrich

SPONGE PRODUCTS DIVISION

281 DERBY PLACE, SHELTON, CONNECTICUT


SILENCE
...never before so "golden"
Cut-away of Jenn-Air QT series Exhauster, showing U-Spring suspension of power assembly. Stainless steel springs guarantee longer life, are more sensitive to both high and low frequency vibrations than ordinary rubber mounting.

Quiet-tested

JENN-AIR ROOF EXHAUSTER

with U-Spring Cushion Suspension Mounting . . . a boon to employee efficiency

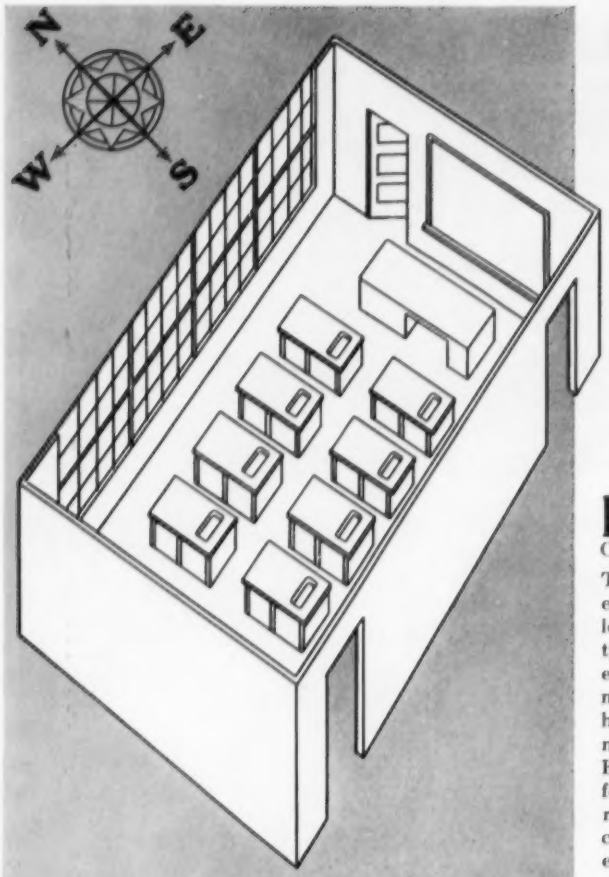
Greater the disturbance—less the productive capacity of employees. Less the disturbance—greater their productive capacity. Now, Jenn-Air's exclusive Quiet-Tested Roof Exhauster virtually eliminates noise caused by vibration. U-Springs suspend the power assembly, isolate it from the base of the unit. Motor and blade are balanced together, as a further safeguard against vibration and noise.

While sharpening up personnel efficiency and worker output, the Jenn-Air Quiet-Tested Exhauster also stacks up dollars in day-by-day savings. Its all-aluminum construction assures better, longer, trouble-free performance. Maintenance costs are practically nil. Motors are lubricated for 10 years of continuous service. Striking, low contour beauty . . . years ahead of the field in neat, trim design.

Only Jenn-Air Quiet-Tested Roof Exhausters are pre-proven under simulated field conditions. Before leaving the factory, each unit must pass rigid inspection by the critical *Vibronic Eye* . . . is "screened" in Jenn-Air's Sound-Elec Test Chamber to detect noise and vibration.

Jenn-Air Exhausters are rated in accordance with the Standard Test Code by the Texas Engineering Experiment Station.

JENN-AIR PRODUCTS COMPANY, INC.
1102 Stadium Drive, Indianapolis 7, Indiana



School Chemistry Laboratory,
North orientation

Dimensions—48′ x 30′, outer wall consisting of windows, regular glazing.

Specifications call for even, reliable heat on the coldest days. Installation must be extra sturdy, able to withstand the rough treatment it will get from generations of teen-agers.

(And, boy, if you want the job, you'd better figure out some way to slash labor time, cut down piping and steam fitting costs to a minimum).

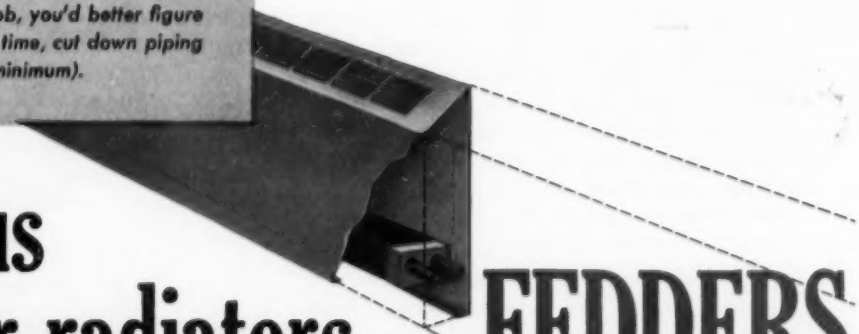
How would you solve this heating job?

For every tough heating job—this big school chem laboratory is typical of what we mean—the new Fedders Continuous Convector-Radiator, known as CTS, is your best solution.

This new, but tested, Fedders product delivers plenty of even, reliable heat — up to 3930 BTU per lineal foot. Its low cost provides more EDR per dollar than conventional types of wall radiation. And how you can pack it in — do the entire 48-foot length with a minimum amount of piping, a minimum number of connections. Slash installation time in half, too. Convector sections are completely factory assembled; nail to studding, semi-finished or plaster walls in seconds. Element tubes are expanded to fit over the adjoining section for sweat connections in seconds. Aluminum fins, ribbed for rigidity, are evenly spaced by die-formed collars which increase metal-to-metal contact between fin and ¾″ O.D. copper element tubes.

And if your installation must stand up under rough treatment in schools this is certainly the wisest choice. Standard 18 gauge top and front, with 16 and 14 gauge available for extra heavy duty. Sloping top prevents convector from being used as a seat or shelf.

The new Fedders Continuous Convector-Radiators come in three basic heights, 4″ or 6″ deep, with or without base grilles. Available in any length from 16″ to five feet in 4″ modules.



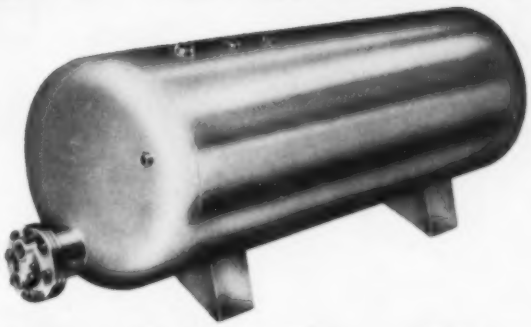
continuous convector-radiators BY FEDDERS

also by Fedders — baseboard, convectors, unit heaters, cabinet heaters

write for complete specs *Representatives, jobbers in all principal cities*

FEDDERS-QUIGAN CORP. • HEATING DIV. • TRENTON 7, NEW JERSEY

SPECIFY



RECO

Three great mines with the same thought

Marquette Range iron mine, near Bessemer, Mich.
H. S. Starin & Assoc., Duluth, Minn.,
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Republic Mine, Republic, Mich.
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Up in the rich iron fields of Michigan, hot water plays an important role in processing iron ore.

RECO storage heaters have earned a solid reputation in this area for delivering gallon after gallon of pure hot water for men and machines.

In many of these mine locations, hard water conditions place a double responsibility on hot water equipment. RECO meets that problem with tough, corrosion resistant Copper Silicon storage heaters. These RECO units keep rust-free hot water flowing under the toughest conditions. And they keep it up for years with a minimum of maintenance.

Add to that the RECO guarantee of top quality at a competitive price and you can see why leading contractors, engineers and architects throughout the nation specify RECO storage heaters as standard equipment.

Rely on RECO's full line of Hot Water Storage Heaters, Instantaneous Heaters and Converters for *your* hot water needs. On your next heating job—SPECIFY RECO.

Richmond Engineering Co., Inc.
Dept. H, 7th & Hospital Sts.
Richmond 5, Virginia—Phone 7-2611

PLEASE SEND: ☐ **Free set of Heat Exchanger Catalogs**
☐ **Name of nearest RECO Representative**

TO_____

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Richmond Engineering Co., Inc.

Uses **LESS** space to heat **MORE** space

Back your bids with the compactness and fuel-thrifty efficiency of Mueller Climatrol gas-fired unit heaters

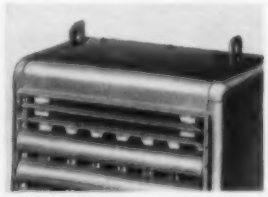
WITH quick, quality-name recognition and a whole host of design refinements, Mueller Climatrol gas-fired unit heaters lend convincing weight to contract talk. Just point out the features . . . the name speaks for itself.

QUALITY FROM BASE TO BRACKETS. Easily installed out of the way, Mueller Climatrol unit heaters with horizontal rear flue vent allow greater installation flexibility and headroom. Quick response to demands for heat is assured with either manual or automatic regulation, thanks to horizontal air tube construction of the heat exchanger which speeds heat transfer. Dependable safety controls . . . heavy-duty, corrosion-resistant cast iron drilled port burner — they're standard in all nine sizes from 25,000 to 225,000 Btu. Oil-fired models also available.

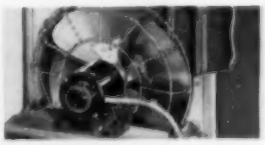
Write for the full story — see why clients respond to Mueller Climatrol quality. Now!

FIRST IN FEATURES

LONG LIFE
Deep burner pouch allows even heat distribution over entire exchanger area with no direct flame impingement. No welded joints in hot gas zone or path of flue travel.



EASY TO INSTALL
Hanger brackets provide easier hoisting into hard-to-get-to positions — providing more headroom where it's needed. Easy to adjust, service.



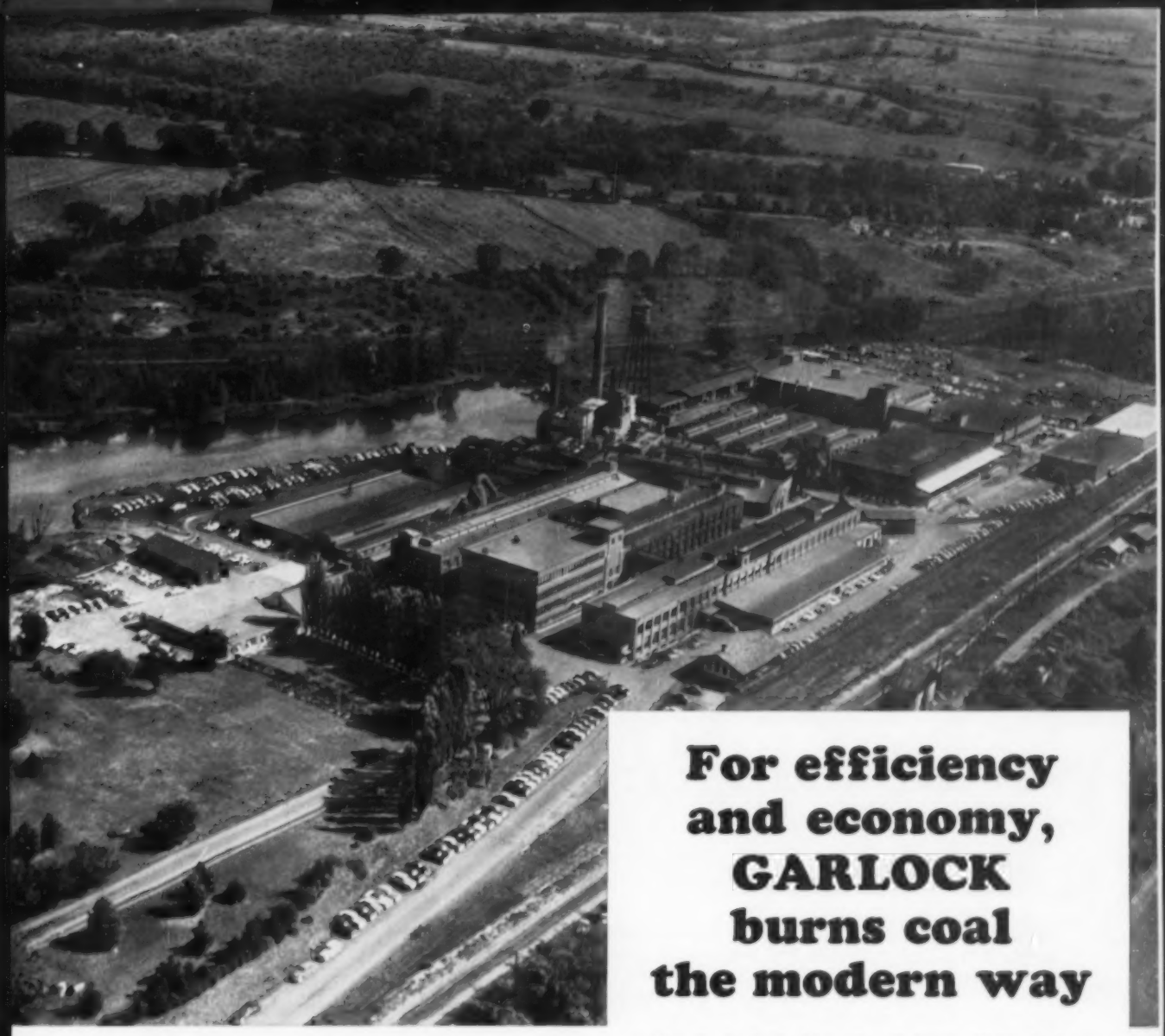
EFFICIENT CIRCULATION
Has special high efficiency, four-blade propeller type fan, dynagraphically balanced for quiet even delivery. Blower styles available.

CORRECT DISTRIBUTION
Louvres can be adjusted to direct heat in any direction required to maintain correct comfort level, without hot blasts. Design insures uniform air distribution.

See your man from

Mueller Climatrol®

Dept. 86, 2034 W. Oklahoma Avenue, Milwaukee 15, Wisconsin



For efficiency and economy, GARLOCK burns coal the modern way

The Garlock Packing Co., Palmyra, N.Y., had a problem common to many growing firms. Production requirements threatened to outpace its power system. Steam capacity and electrical distribution were inadequate; heat balance was poor; equipment was obsolete. Any minor repair or inspection meant curtailed production. So Garlock called in Consultant L. J. Sforzini to study the situation and make recommendations.

The answer was *modernization* and today Garlock burns coal the modern way. A new 100,000 lb.-per-hr. spreader-stoker fired boiler, using older units as standbys, delivers steam for all needs with enough surplus capacity to handle a load growth. Cinder reinjection has improved stoker-firing efficiency. Pneumatic ash handling facilitates overall operation. With these and other changes, Garlock's power plant now operates at peak efficiency and economy.

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

NATIONAL COAL ASSOCIATION
Southern Building • Washington 5, D. C.

Consult an engineering firm

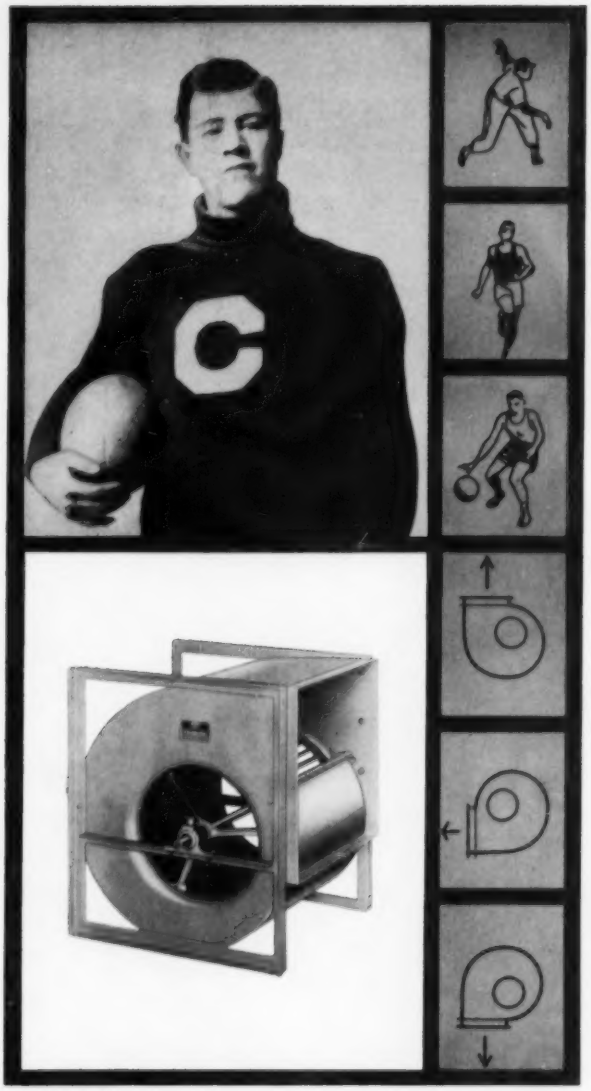
Designing and building hundreds of heating and power installations a year, qualified engineering firms can bring you the latest knowledge of fuel costs and equipment. If you are planning the construction of new heating or power facilities—or the remodeling of an existing installation—one of these concerns will work closely with your own engineering department to effect substantial savings not only in efficiency but in fuel economy over the years.

facts you should know about coal

In most industrial areas, bituminous coal is the lowest-cost fuel available • Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar • Automatic coal and ash handling systems can cut your labor cost to a minimum. Coal is the safest fuel to store and use • No smoke or dust problems when coal is burned with modern equipment • Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

all-around MAN

all-around FAN



Remember the great Jim Thorpe? He could move from sport to sport . . . be a champion in all sports. Baseball, football, track, field—you name it—Jim could play it like the hero he was. Truly, he deserved the accolade "all-around man" of the sports world.

At Utility, we have an all-around blower as versatile as Mr. Thorpe in performing well at a number of jobs. A 4-Way Discharge Blower, it adjusts quickly to any of four positions—top horizontal, top vertical, bottom horizontal or bottom vertical. Actually, it's an **eight**-position fan, since it faces left or right at any of the above angles.

The rigid frame is the key to this blower's complete convertibility. You simply place the fan in the desired discharge position, and the job is done—without bolts or screws or costly sheet metal work. The rigid frame also adds a bonus of strength and stability to the installation. It's a boon from an inventory standpoint. Available in single and double widths, this blower takes care of many jobs without emergency re-ordering or cutting-to-fit on the job.

Of course, world-renowned Utility quality is built right in, with one-piece wheel for rigidity, long life and whisper-quiet operation. And because of Utility's years-ahead production techniques, this "all-around fan" is priced right down with the lowest. Proving again that when quality and price must get together, it makes sense to "get together" with Utility!

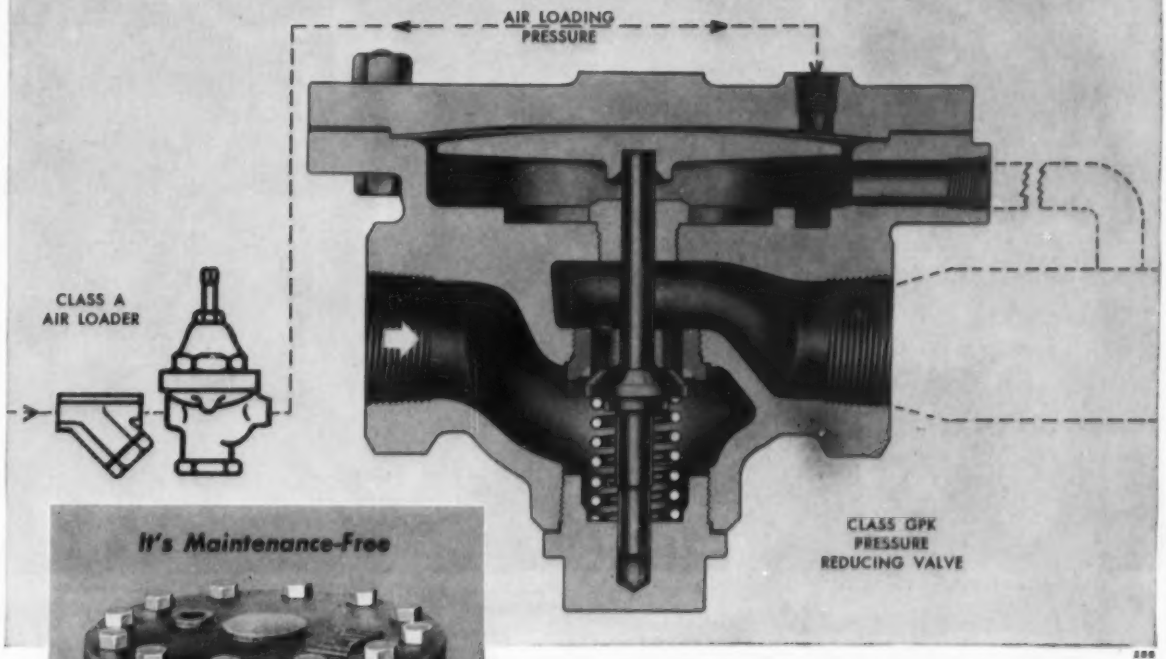
A Division of Utility Appliance Corp.

UTILITY FAN CORP.

911 East 59th Street, Los Angeles 1, California

Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Producers of blowers and blower parts for original equipment manufacturers. Write for catalogue data.

No maintenance inspection on this new valve until 1959!



You can just put this amazingly simple and compact Leslie Class GPK-A pressure reducing valve on the line and forget it for at least 3 years!

YES, AND THAT'S A *GUARANTEE* backed by a reputation for quality established in more than half a century of design, development and manufacture of regulators and controllers.

This amazing new, diaphragm operated, Leslie pressure reducing valve has *only two moving parts:* no seals; no stuffing boxes; no small, dirt-catching parts.

A simple air loader eliminates the conventional bulky loading spring and provides accurate diaphragm loading that gives pilot-type response. Yet, it is rugged and uncomplicated. The unit itself lends itself readily where remote adjustment is an advantage, too. And you pay no price premium for these advantages. You get Leslie quality for about the same initial cost as leading makes of ordinary regulators.

Suitable for any steam service up to 250 psi, 450°F, the unit is available in ½" to 2" sizes. It is ideal for intermittent service too, and is unaffected by dirty steam.

Your Leslie engineer can give you all the data on this amazing valve. You'll find him listed in your classified directory under "Valves" or "Regulators".

Send for YOUR copy of Bulletin 561 today.

TRADE LESLIE MARK

REGULATORS AND CONTROLLERS

LESLIE CO., 237 GRANT AVENUE, LYNDHURST, NEW JERSEY

Peerless Development Engineer Richard Thompson (at control board) guides unit through development and George Goldner conducts final inspection.

VERIFIED BLOWER PERFORMANCE

● It just makes good sense to specify Peerless. Every fan or blower leaving our plant is unconditionally guaranteed to meet all established industry test codes (NAFM or PFMA). To an engineer, guaranteed performance means specifying without doubt—to a contractor it means good performance and no callbacks.

OUTSTANDING PERFORMANCE. The outstanding service records of Peerless fans and blowers stem from excellent design and thorough tests in every step of development and manufacture. A minimum of eight, 20-point determinations are made during the development period alone.

100% INSPECTION. Every unit (including the job-matched Peerless custom-built motor) receives 100% inspection before it leaves our plant. Wheel alignment and lubrication are checked . . . variable pitch pulleys are adjusted to correct motor RPM for exact CFM . . . angle of discharge is set . . . each unit is ready to go when you receive it.

COMPLETE LINE. There is a Peerless fan or blower for virtually every application. Complete data is catalogued for easy reference. Peerless Bulletin SDA-160 shows fans and forward curve blowers. Bulletin SDA-200 gives complete data on backward curve blowers (NAFM) from 12½" to 36½". These two bulletins will help you solve most air-moving problems. To get your copy, use the coupon below. Dimension prints are available on request.

FAN AND BLOWER DIVISION

Peerless Electric

THE PEERLESS ELECTRIC COMPANY

1409 W. MARKET ST. • WARREN, OHIO

FANS · BLOWERS · MOTORS · ELECTRONIC EQUIPMENT

THE PEERLESS ELECTRIC CO.

WARREN, OHIO

☐ Send me Bulletin SDA-160.

☐ Send me Bulletin SDA-200.

NAME.....

TITLE.....

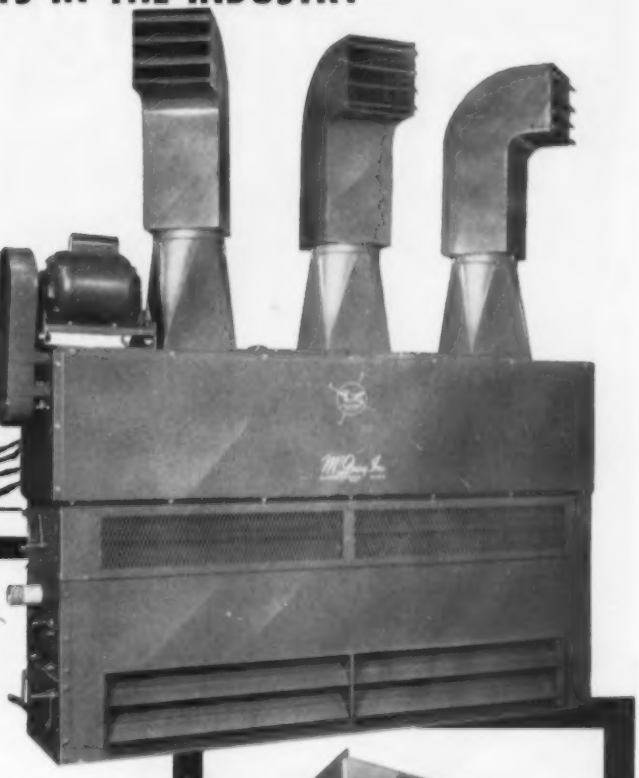
COMPANY.....

ADDRESS.....

to make or meet specifications

McQuay HC Line

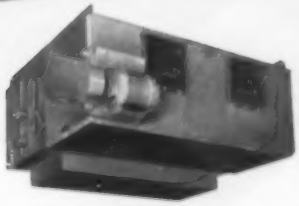
THE MOST VERSATILE HEATING AND VENTILATING UNITS IN THE INDUSTRY



The McQuay "HC" line has been designed for a wide range of applications . . . schools, churches, industrial plants, public and office buildings and other installations . . . wherever quiet, high volume heating and ventilating is required.

Solve your specification problems with McQuay "HC" units where you may select from 17 sizes ranging in capacity from 1280 CFM to 32,500 CFM. You also have a choice of—not two or three— but *eight* capacity ranges in both standard and jet tube steam coils. (Or up to four rows of hot water coil if you prefer.)

In addition to this versatility in capacity, you have eight fan discharge arrangements and 18 accessory arrangements to choose from. All arrangements are illustrated in *Catalog 344*. Write for your copy today or contact the McQuay representative nearest you.



Type "H" with internal by-pass

Type "V" with external by-pass

McQuay representatives in all major cities

McQuay Inc.

MAKE THE SEASONS COME TO YOU

1600 BROADWAY N. E., MINNEAPOLIS 13, MINN.

HEATING • AIR CONDITIONING • REFRIGERATION

the New "66 TOTE TRAY" for nipples saves you time on-the-job

● Now you can buy popular size ½" or ¾" black or galvanized nipples in the handy TOTE TRAY shown here. This rugged, easy-to-carry tray eliminates wasted steps on the job. No more pawing search—the right nipple is always ready at hand—in its own clearly marked space. Convenient measuring guide gives instant length verification for each of the 66 nipples in eleven lengths ranging from Close to 6".

Tray is of sturdy, double corrugated board construction. There are no staples to catch or scratch your hands. Finish is attractive silver grain. Each tray is individually packed in and protected by sturdy shipping cover.

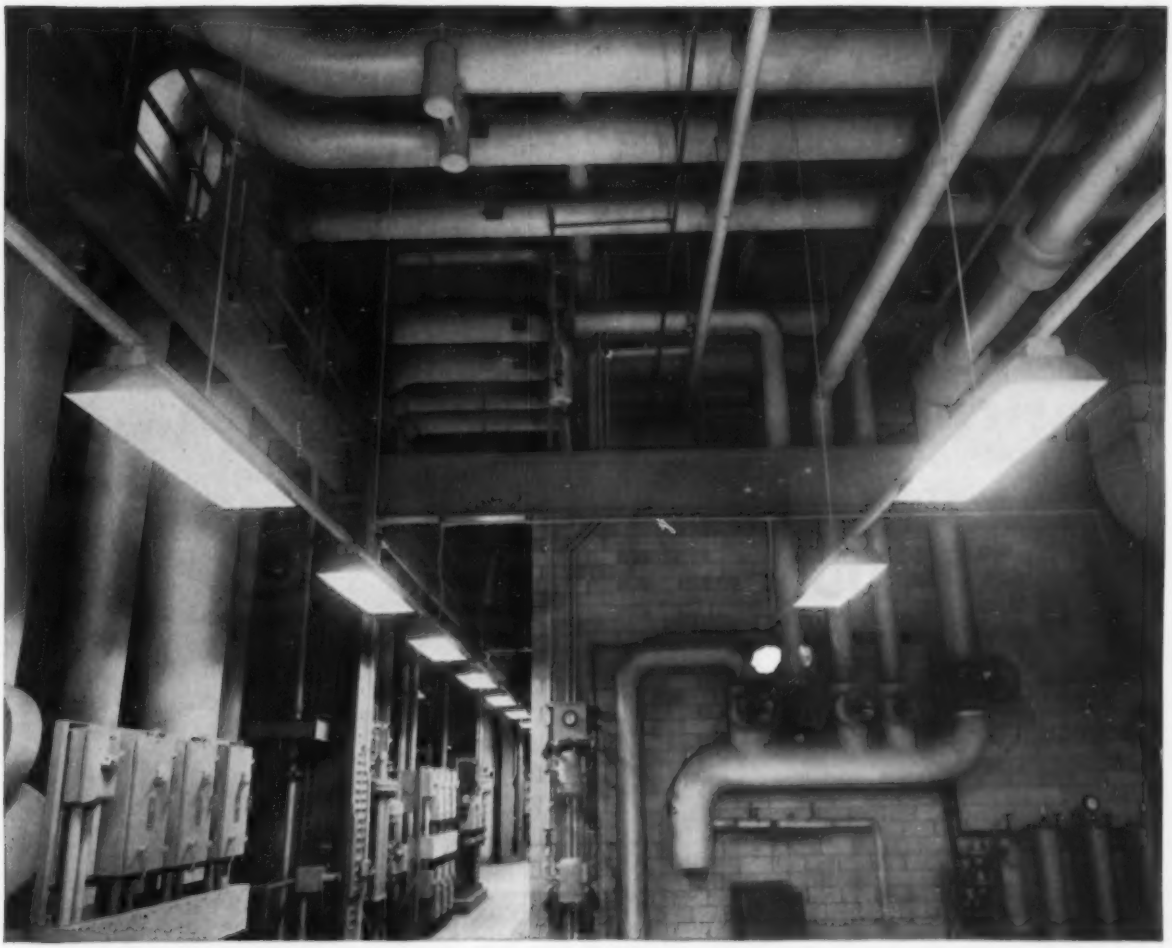
For your protection all U-brand nipples are made from new, mill-tested pipe. Special attention is given to true thread gauge, inside ream and outside chamfer. After machining, nipples are thoroughly cleaned and rust protected. In regular carton packaging U-brand nipples are available in ⅛" to 2" diameters in lengths up to 6". Larger nipples up to 4" diameter in any length are available in bulk.

A SINGLE SOURCE FOR ALL YOUR PIPE FITTING NEEDS

Galvanized and Black U-Cote Malleable Iron Pipe Fittings—Unions—Plugs and Bushings—Cast Iron Drainage and Screwed Fittings—Steel Nipples and Couplings—Insert Fittings for Plastic Pipe.

U BRAND

The Union Malleable Manufacturing Company
Ashland, Ohio



NO HEAT LOSSES HERE! At TVA Widows Creek Power Plant, the vertical main steam line at left is insulated with 3" of K&M Hy-Temp and 2" of "Featherweight" 85% Magnesia. Distribution manifold and branch mains are insulated with 2" 85% Magnesia. Insulation contractor, Armstrong Cork Company.

K&M HIGH-PRESSURE INSULATIONS MEAN IMPORTANT HEAT SAVINGS

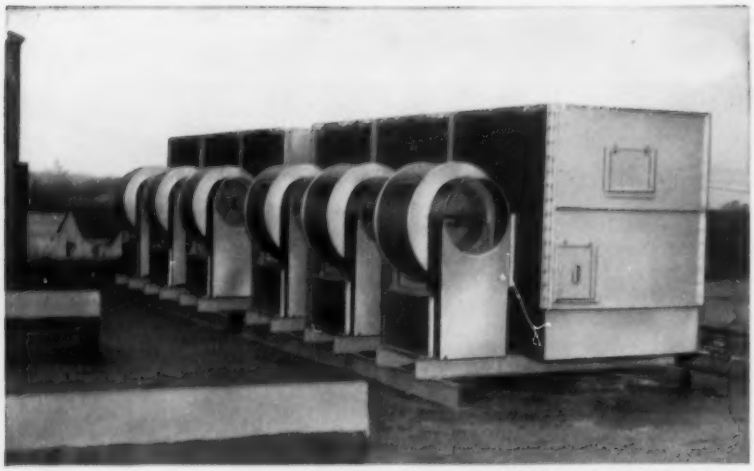
Piping heat-losses can be high if insulations are not designed for specific applications. K&M High-Pressure Insulations are so designed—to cut waste and save you money. There is a K&M High-Pressure Insulation for your every requirement.

For efficiency to 1900° F. there's K&M Hy-Temp Combination Insulation. It's made of diatomaceous silica, heat-resistant fillers and asbestos fiber, overlaid with K&M "Featherweight"® 85% Magnesia. Joints are staggered for the utmost in heating efficiency.

For efficiency to 600° F. there's K&M "Featherweight" 85% Magnesia. Made of 85% basic carbonate of magnesia and asbestos fiber, "Featherweight" withstands moisture, vibration and frequent temperature changes.

Contact your K&M distributor, who is an experienced applicator, or write directly to us, for further information.

KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA



These low and compact Binks Series 3-B forced draft cooling towers do an efficient job of cooling process water for the Johnston Foil Manufacturing Co., St. Louis, Mo.

At Johnston Foil Manufacturing Co.

Binks cooling towers cut water bill 75%

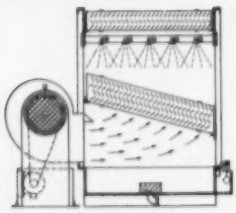
As producers of aluminum, tin and lead foil, Johnston Foil uses water ...and lot's of it...to cool the foil mill and drying rolls. Before installing Binks cooling towers, city water was used on a one-pass basis. Now water is recycled and the heat dissipated by two, triple-blower Type-B cooling towers. Only make-up water is required.

Compare these construction features—Johnston Foil did.

Whisper-quiet operation. Squirrel cage blowers have tip speeds only ⅓ that of propeller-type fans.

Low silhouette. Over-all height of largest capacity tower is only 7'6"—they're seldom visible at street level.

High Efficiency. Binks patented Roto-jet spray nozzles plus internal redwood nailless decking assure thorough water breakup. Scientifically balanced air-to-water ratio gives high cooling efficiency under all climatic conditions.



Cross-section showing counter-flow air-water movement employed in Binks Series 3-B towers.

Minimum maintenance. Blowers and motors are outside the tower—not in the moisture-laden air stream. All panels are heavily galvanized. Outsides of towers have two coats of aluminum paint—insides, a tough, durable zinc chromate coating.

For full information
on Binks complete line of mechanical and natural draft cooling towers, write direct to the address below. Binks engineers will gladly study your needs and help you select the right tower for your particular requirements.

647

Binks
EVERYTHING FOR WATER COOLING

A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

Binks Manufacturing Company
3118-38 Carroll Ave., Chicago 12, Ill.

REPRESENTATIVES IN PRINCIPAL U.S. & CANADIAN CITIES • SEE YOUR CLASSIFIED DIRECTORY

EQUIPMENT DEVELOPMENTS

Continued from page 168

Relief Valve . . .

. . .for hot water boilers, heaters, storage tanks—*A. W. Cash Valve Mfg. Corp., Dept. HPAC, 666 E. Wabash Ave., Decatur, Ill.*

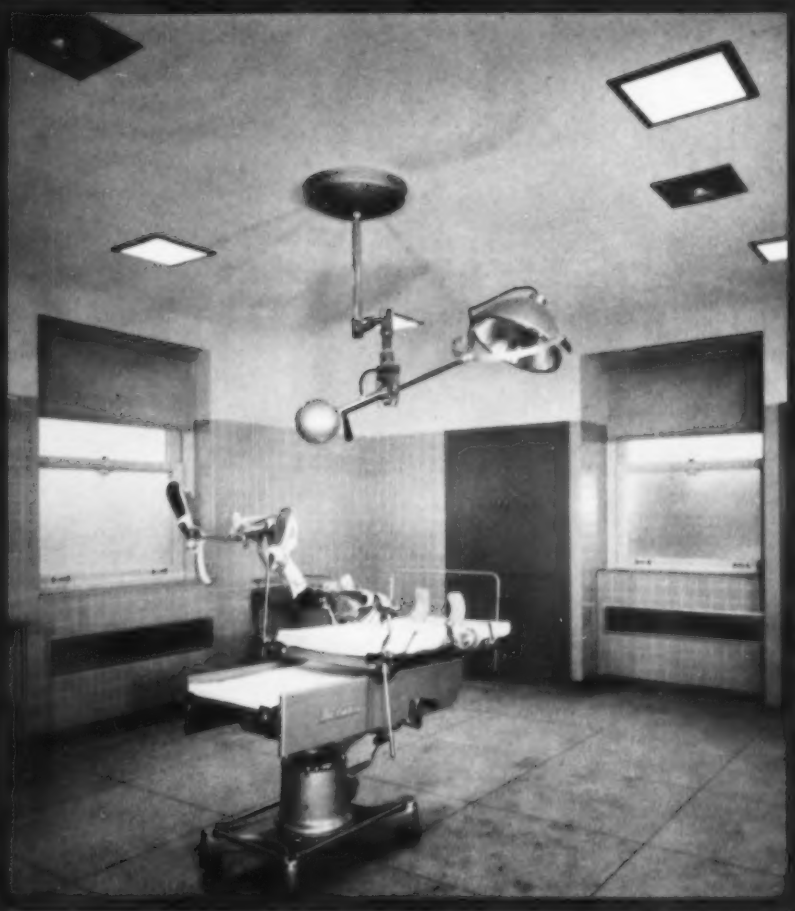
Valves have cast bronze rustproof bodies, heat resisting silicone seat discs, accurate-setting stainless steel springs; high-lift design, large passageways, says company. In sizes ¾ in. to 2 in; ASME relief capacities 365,000 to 14,400,000 Btu per hr. Pressure relief range is 30 to 150 lb.

Electric Baseboard . . .

. . .incorporating finned tube baseboard with "electric core" through same radiator element that uses steam, hot water—*Vulcan Radiator Co., Dept. HPAC, 775 Capitol Ave., Hartford 6, Conn.*

In 3, 4, 5, 6, 8, 12 ft lengths; available for either 208, 230 volts. For average outside temperatures, unit uses one half of full capacity. When temperatures become extremely cold, second element automatically turns on. The opposite is true as soon as room temperatures reach normal.

Photos: A. R. Gilbert



▲ To provide draftless air diffusion in the delivery room, All-Air High Velocity units are placed under the window. High velocity sound attenuation chambers with square diffusers are mounted in the ceiling. *Turn page for detail.*

▼ In the nursery for premature infants, sound attenuation chambers with square air diffusers are mounted in the ceiling. *Turn page for detail.*

A new high in

high velocity for hospitals

New wing of Abington Memorial Hospital, Abington, Pa.

Architects & Engineers:
Jack Steele Company, Philadelphia, Pa.
Schmidt, Garden & Erikson, Chicago, Ill.

Air Conditioning Contractors:
Huffman-Wolfe Company, Philadelphia, Pa.
Paul A. Norair, Washington, D. C.

▲ All-Air High Velocity under-the-window units are used in all private and semi-private patients' rooms. *Turn page for detail.*

Here are shown applications of the Anemostat All-Air High Velocity air distribution system in the new wing of the Abington Memorial Hospital.

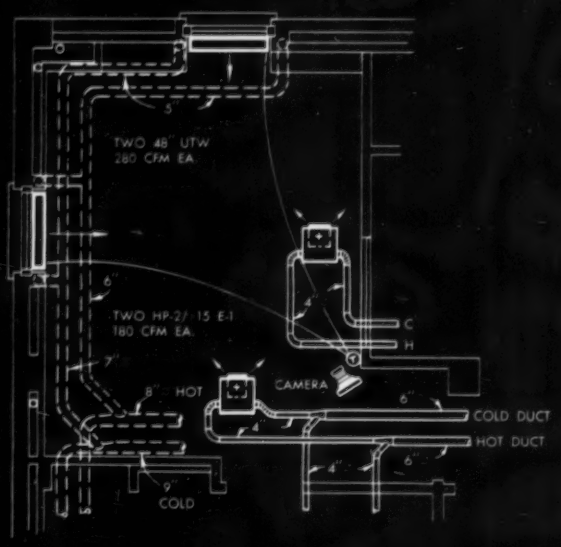
The trend towards Anemostat All-Air High Velocity Systems is growing rapidly. The Anemostat All-Air High Velocity air distribution system can be used with smaller than conventional ducts. It can be installed faster and at less cost. It requires no coils, thus eliminates leakage, clogging and odors. These units save space when installed in hospitals, office buildings, department stores, banks, schools, factories and other structures.

ARCHITECTS—Attention Please:

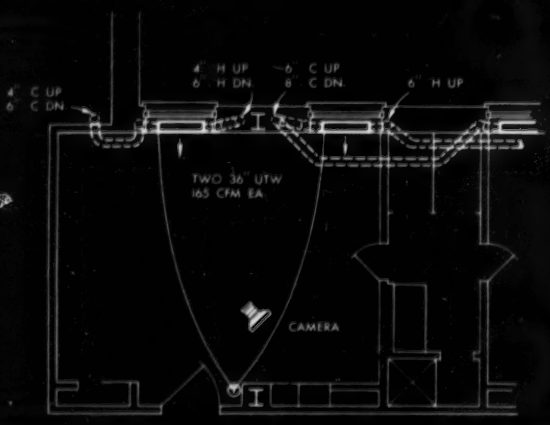
Anemostat round, square and straightline diffusers with high velocity units complement a wide variety of architectural designs.

Write on your business letterhead for 1956 New Products Bulletin and Selection Manual 50

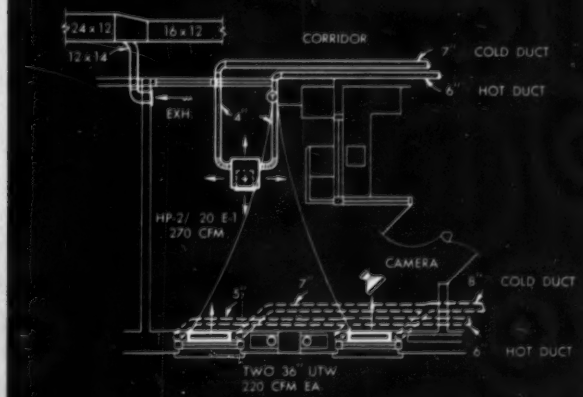
Delivery room



Patients' room



Premature Nursery



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DRAFTLESS *Aspirating* **AIR DIFFUSERS**

ANEMOSTAT CORPORATION OF AMERICA

10 East 39th Street, New York 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

The Pioneer of All-Air High Velocity Systems

AC 1339

EQUIPMENT DEVELOPMENTS

Continued

Combustion Test Kit . . .

. . .designed to check CO_2 content, draft, stack temperature, smoke in gas, oil or coal fired installations—*F. W. Dwyer Mfg. Co., Dept. HPAC, P. O. Box 373, Michigan City, Ind.*

Once set up, gages can be read in 30 seconds, says company. Reads to plus or minus ½ of 1 percent CO_2.

Float Valve . . .

. . .with "heavy duty" compound lever — *Robert Mfg. Co., Dept. HPAC, 9035 Venice Blvd., Los Angeles 34.*

Is said to maintain liquid levels with positive shutoff. Available in brass in sizes 1¼ and 1½ in. Cited applications include large cooling towers or evaporative air conditioning units, evaporative condensers, industrial processing, water storage tanks.

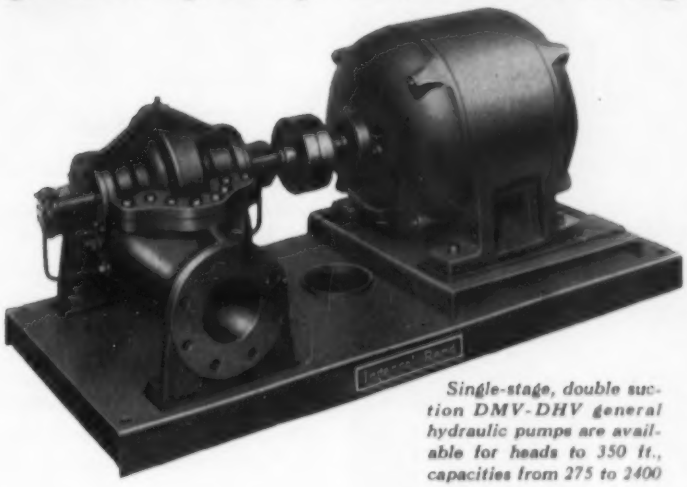
1 Hp Conditioner . . .

. . .added to company's line—*Fedders Quigan Corp., Dept. HPAC, 5801 Grand Ave., Maspeth, N. Y.*

Operates on 115 volt line. Draws no more than 12 amperes, creates cooling comparable to currently available 1 hp, 208 or 230 volt units without incurring cost of bringing in high voltage from street, says company.

HERE'S EXTRA PROTECTION

against pump shaft leakage



Single-stage, double suction DMV-DHV general hydraulic pumps are available for heads to 350 ft., capacities from 275 to 2400 gpm.

Use of double mechanical shaft seals in

DMV-DHV PUMP LINE

ends stuffing box maintenance

This modern DMV-DHV pump *is different!* Gone are the conventional packed stuffing boxes—with their periodic tightening, repacking, and annoying shaft leakage.

Double Mechanical Shaft Seals are standard equipment. Self-adjusting, they require no attention throughout their entire service life. Leakage is effectively prevented.

NO BEARING LUBRICATION

Another advanced design feature of the DMV-DHV pump that helps eliminate maintenance problems is the use of Cartridge-Type Bearings. The lubricant is permanently sealed in. This means successful operation for many years —in tough installations—without any servicing.

Greater Compactness is obtained with this modern construction using mechanical shaft seals and sealed bearings.

Contact your nearest I-R branch office for full details. Or write for Bulletin 7248-A.

Ingersoll-Rand

10-289 Cameron Pump Division
11 Broadway, New York 4, N. Y.

PUMPS • CONDENSERS • TURBO-BLOWERS • COMPRESSORS • ROCK DRILLS
DIESEL & GAS ENGINES • AIR & ELECTRIC TOOLS

Raypak

Extended Surface, copper tube, gas fired

HOT WATER BOILER of ADVANCED DESIGN

3 times the BTU's per pound of weight

YET FAR STRONGER

Specifically designed for baseboard radiation and radiant panel heating, swimming pools and air conditioning systems. All heating models feature Raypak Gas Modulation, swimming pool models feature self-generating electrical system.

Specify Raypak, the originators of the "Plug-In", package Boiler.

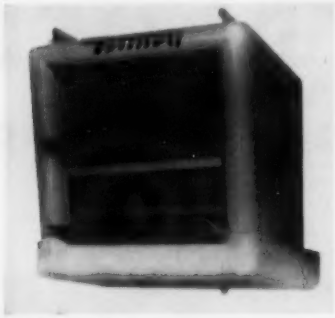
Throughout the country Raypak Company selects specialized and skilled representatives to handle sales and help solve your Boiler problems.

Raypak

RAYPAK COMPANY, INC.
Engineers-Manufacturers
2416 Chico Ave El Monte, California

EQUIPMENT DEVELOPMENTS

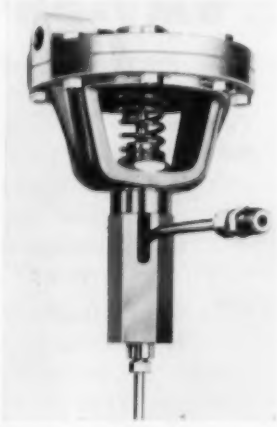
Continued



Unit Cooler . . .

. . . for three-step installation—*Tenney Engineering, Inc., Dept. HPAC, 1090 Springfield Rd., Union, N.J.*

Features include suction line provision for expansion valve bulb location, integral heat exchanger, aluminum fins mechanically bonded on electro-tin plated copper tube, adjustable louvers, vibration mounted motor. To install: hang template mount; slide unit into place on rail hangers; connect refrigerant, power, drain lines.



Sphincter Valve . . .

. . . designed for handling erosive process flows, flows containing gritty solids which cannot tolerate pockets but accept neoprene, natural rubber —*George W. Dahl Co., Inc., Dept. HPAC, 430 High Street, Bristol, R. I.*

Will produce minimum turbulence in flow through valve, is for use on slurry service where solids in suspension tend to plug conventional type control valve, says company. Available in ¾ and ¼ in. OD tubing sizes.

for INDUSTRIAL and AIR CONDITIONING SERVICE . . .

Phillie Gear *standardized*

HI-SPEED REDUCER INCREASER

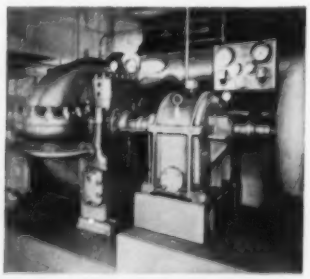
These modern, ruggedly-built Standardized Units contain all the features and advantages of custom-built units; being specially designed for *increaser or reducer applications*—where rotating speeds range as high as 9000 r.p.m., or pitch line velocities up to 10,000 feet per minute.

Phillie Gear Hi-Speed Units meet the current trend toward higher prime-mover speeds of steam turbines, ultra high speed electric motors, or internal combustion engines—for driving Compressors, Pumps, etc. at *reduced speeds*, or the *increased speed* required for driving many Pumps, Compressors, Fans and Generators.

All helical gears and shafts are dynamically balanced to give the ultimate in vibration-free power transmission.

These Hi-Speed Units are available for horsepowers from 1 to 7,100; ratios 1:1 to 10:1, for either speed increasing or speed reducing.

Send for Catalog HI-55.



A Phillie Gear HI-SPEED Air Conditioning Drive Installation, Sears Roebuck Co., Pittsburgh, Pa. Input 342 HP with 1:3.56 Increase, Output speed 6230 RPM

phillie gear®

PHILADELPHIA GEAR WORKS, INC.
ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS
LIMITORQUE VALVE CONTROLS
FLUID AGITATORS • FLEXIBLE COUPLINGS

Virginia Gear & Machine Corp. • Lynchburg, Va.

More *Janitrol* Gas-Fired Unit Heaters are specified to replace heating "failures" than any other kind!

Any unit heater brand can *claim* dependability and long, economical service life.

But only when such claims are backed by actual performance records are you on firm ground when it comes to buying!

Consider this: Less than ¼ of 1% of over a million Janitrol Multi-Thermex heat exchanger tubes installed since 1940 have failed for all causes. That's proof of performance you can count on for dependable heating and extra years of care-free service.

No wonder Janitrol gas-fired unit heaters are first choice to replace the "failures"—are re-specified time after time for plant additions, modernizing, new construction.

Janitrol unit heaters are available for "dual-fuel" operation; can be installed to heat with either LP gas or natural gas, and may be switched from one fuel to the other automatically to meet needs of users in areas where natural gas is not always available.

For complete information on Janitrol gas unit heaters and their installation, write for booklet JS-221—"Engineering Ingenuity in Gas Unit Heating". Or, ask your Janitrol dealer for a copy.

Janitrol
GAS-FIRED UNIT HEATERS

JANITROL HEATING AND AIR CONDITIONING DIVISION
SURFACE COMBUSTION CORP., COLUMBUS 16, OHIO
IN CANADA: MOFFAT HEATING AND AIR CONDITIONING
DIVISION OF MOFFATS, LTD., TORONTO 15.

ALSO MAKERS OF *Surface* INDUSTRIAL FURNACES AND *Kathabar* HUMIDITY CONDITIONING

THE NEW *Airtherm* AIR CONDITIONING UNIT

REMOTE TYPE FOR HEATING • COOLING • VENTILATING

OFFERS THE BEST FEATURES AVAILABLE IN THE INDUSTRY

FOR NEW OR MODERNIZED

√OFFICES √APARTMENTS

√MOTELS √INSTITUTIONS

√HOTELS √PUBLIC BUILDINGS

The new Airtherm Unit uses a central source of hot water for heating, chilled water for cooling and combines the best features the industry has developed through the years.

This "Feature Research" guarantees you the greatest possible versatility of installation, efficiency of operation and dependability.

Airtherm Units are made in four series, from ½ to 2 ton nominal cooling capacity, for cabinet or concealed type installation, floor or ceiling.

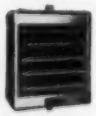
We'll be glad to send you complete specifications if you will send us the coupon below.

MAIL COUPON FOR SPECIFICATIONS

AIRTHERM HEATING AND VENTILATING PRODUCTS

Cabinet Unit Heater

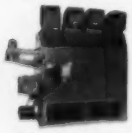
Gas Fired Unit Heater



Propeller Fan Unit Heater

Convector

Centrifugal Fan Unit Heater



Direct Fired Space Heater

Airtherm Manufacturing Co. Dept. A
700 S. Spring • St. Louis 3, Mo.

Please send me complete specifications on your new Airtherm Air Conditioning Units, Cabinet Unit Heaters, Convectors, Gas Fired Unit Heaters, Propeller Fan Unit Heaters, Centrifugal Fan Unit Heaters, Direct Fired Space Heaters. (Circle those desired.)

NAME_____

FIRM_____

STREET ADDRESS_____

CITY_____ STATE_____

The One Pipe Wrench that
Out-performs
and Out-lasts
all others...

Genuine Heavy-Duty
RIDGID

This pipe wrench does its job so well that millions of users swear by it.
It's extra strong and safe—sure jaw action aided by new patented hookjaw suspension.

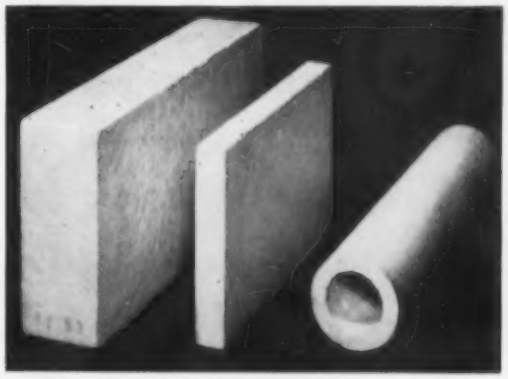
Grips pipe or conduit instantly, no slip, no lock. Rugged comfort-grip I-beam handle ...handy pipe scale and easy-spin adjusting nut. Every wrench factory-tested, 6" to 60" ...to assure you *most* for your money. Buy RIDGIDs at your Supply House!

RIDGID
Work-Saver Pipe Tools

The Ridge Tool Company, Elyria, Ohio, U.S.A.

EQUIPMENT DEVELOPMENTS

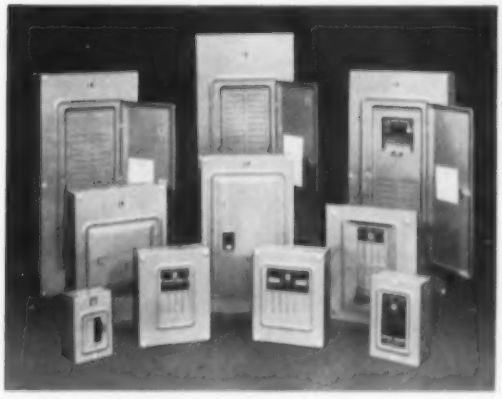
Continued



Low Temperature Insulator . . .

. . . featuring low *K* factor, lightness of weight, ease of installation—*United Cork Co., Dept. HPAC, Central Ave., Kearny, N.J.*

Flexible polystyrene in thin sections makes possible easy installation around curved surfaces. Rate of heat transfer is low; moisture absorption less than ½ of 1 percent even after days of total submergence; coefficient of expansion is small, approximately that of tin; says company.



Load Centers . . .

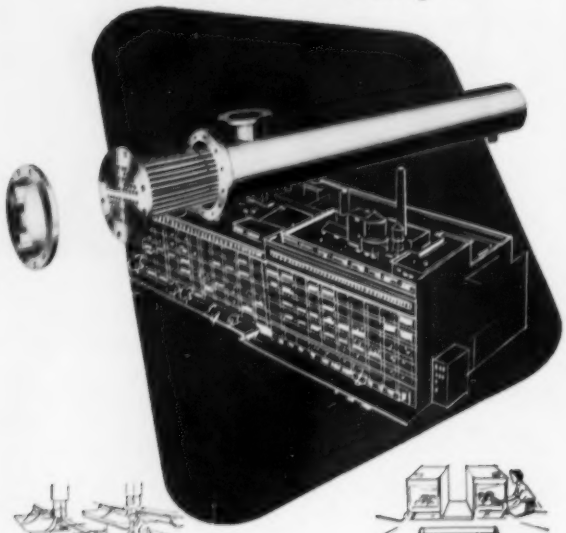
. . . with panelboard breakers—*Square D Co., Dept. HPAC, 6060 Rivard St., Detroit* 11.

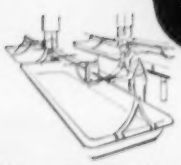
"Swingrip" mounting feature assures proper positioning of breaker, firm, positive connection in one operation, says company. Non-interchangeability feature discourages substitution of 30, 40 or 50 amp breakers where 15 or 20 amp devices originally have been installed. Incorporates quick-make quick-break, ambient-compensated, thermal-magnetic features. Two to 8 circuit devices available without doors, 12, 20, 30, 42 circuit devices furnished with doors. For commercial, light industrial applications.

Radiation Element . . .

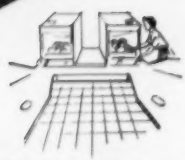
. . . features 48 fins per ft—*Schemenauer Mfg. Corp., Dept. HPAC,* 110 *Kittle Rd., Holland, O.*

How would you heat 100,000 GALLONS of water daily?





Plenty of 140° F hot water is always available at Schrader Valve, supplied by dependable Taco Instantaneous Heaters.



180° F hot water is supplied Schrader's cafeteria where approximately 2,000 employees are served daily.

Here's how Schrader Valve Company does it!

They use 5 Taco Instantaneous Heaters. Every day of the year these 5 Tacos heat 100,000 gallons of water with 5 lb. live steam to 140° or 180°F. All Schrader hot water requirements . . . and there are *many* . . . are amply met by rugged, trouble-free Tacos *without a major repair in 18 years.*

Proof that you can depend on Taco to solve your hot water problem quickly, efficiently and economically. Mail coupon for Simplified Selection Chart today.

TACO HEATERS, INCORPORATED

1160 Cranston Street, Cranston 9, Rhode Island
342 Madison Ave., N.Y. 17, N.Y. • 4 Gilead Place, Toronto 2, Can.

BETTER HEATING — Taco — BETTER WITH TACO

Send Simplified Selection Chart to:

Name .....

Address .....

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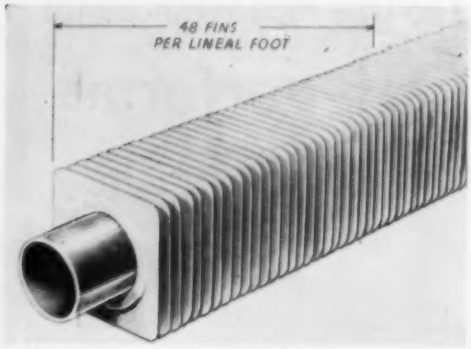
EQUIPMENT DEVELOPMENTS

Continued

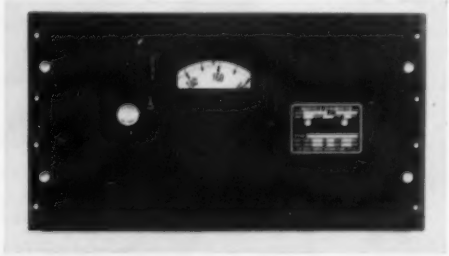


Element is combination of 3¼×3¼ in. fins on 1¼ in. iron pipe with 48 fins per ft, increasing heat radiation surface 35 to 40 percent, says company. Each fin has collar which makes contact between fins for proper spacing, said to provide efficient heat transfer.

Oil Burner Nozzle Adapter . . .

. . . with smooth seats to provide "metal-to-metal" seal at nozzle end—*Chicago Screw Co., Dept. HPAC, 2701 Washington Blvd., Bellwood, Ill.*

Steel adapter available in: nozzle end tapped 9/16 in. to fit standard nozzle; oil line and tapped 1/8 in. pipe for standard fitting. Both furnished with 11/16 in. hexagon in center of piece, also with ¾ in. hexagon on end of piece. Cadmium plating provides protection against corrosion, says company.



Electronic Potentiometer . . .

. . . with pneumatic transmitter designed to send 3-15 psi signal proportional to measured variable—*Bristol Co., Dept. HPAC, Waterbury, Conn.*

Will measure any variable which can be translated into electrical quantity, says company. Available either "blind" or with indicating scale.

Heating, Cooling System . . .

. . . designed for proper circulation, distribution of cool, warm air—*Iron Fireman Mfg. Co., Dept. HPAC, 3170 W. 106th St., Cleveland, 11.*

"SelecTemp" heating system, "In-the-Wall" cooler are said to provide accurate control both winter and summer. Heater unit supplied by low pressure steam from central boiler. Each has own thermostat. Twin

PROGRESSIVE MODERNIZATION PROGRAM IN AKRON SCHOOLS EFFECTS FUEL SAVINGS AS HIGH AS 30%

EDWIN M. BLISS—*School Board Architect* • MAYER & VALENTINE—*Consulting Engineers* • *CHARLES N. MILLER—*Supervisor of Custodians*

3 Canton Vulcan Heavy Duty Ram Type Stokers with 1100# Hoppers

CLEVELAND "Lectricarm" Drive Units position the multi-vane damper on fan intake. One "Lectricarm" is equipped with integral fuel feed timer which governs operation of all stoker drive motors to provide desired fuel-air ratio. The upper "Lectricarms" control uptake dampers.

CLEVELAND

COMBUSTION CONTROL SYSTEMS

*". . . repeatedly specified and used during 8-year period in new and existing schools . . . for oil, coal or gas," says *Charles N. Miller, Supervisor of Custodians.*

BUCHTEL HIGH SCHOOL—1 of 18 Installations

OBJECTIVE: Eliminate old-fashioned manual operation with its attendant higher operating costs of fuel and labor. Simplify boiler room operation.

INSTRUMENTATION: Master Regulator or steam control with 3 "Lectricarms" for automatic proportioning of fuel and air feed; controls all three boilers. Sequence Damper Control for each boiler maintains constant overfire draft rate regardless of firing rate and barometric changes by energizing 3 additional "Lectricarm" Drive Units linked to uptake dampers. Overfire draft and windbox Pressure Gages indicate changing conditions.

BENEFITS: Saved 30% fuel. Saved 65% labor. Increased life of all equipment.

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Company _____
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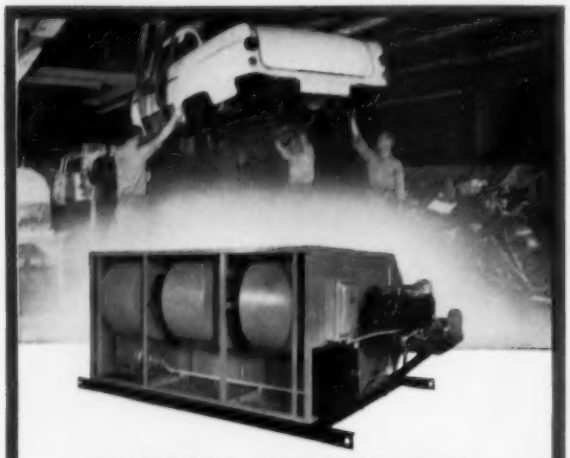
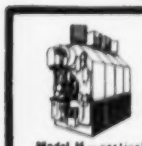


LEADING AUTOMOBILE MANUFACTURERS place their confidence in

NATIONAL Champion
DIRECT FIRED HEATERS



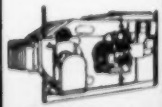
Model H — vertical unit with discharge heads. 12 sizes.

Model D — vertical unit for duct work. 12 sizes.

Model P — portable, vertical unit for flexible duty. 6 sizes.

Model H — inverted unit with discharge heads at bottom. 12 sizes.

Model S — vertical unit with side blowers to permit proper location of air mixing dampers. 12 sizes.



Model C — horizontal ceiling suspension unit for space saving. 12 sizes.

Where make-up air and tempering is a problem — a National Champion heater is your answer.

And where space is a prime consideration, the National Champion Model C horizontal ceiling suspension unit is unexcelled. No matter how large or small your plant may be, there's a National Champion heater designed to do the job with the utmost economy and efficiency. All National Heaters feature the lifetime "teardrop design" stainless steel combustion chamber. National Champions come in 6 models — 66 sizes, from 200,000 to 2,000,000 BTU capacities. Check these outstanding features.

- 80% guaranteed heating efficiency
- Direct fired for gas, oil or combination fuels
- Completely automatic controls — for constant, clean heat
- 70%-150% more heat transfer area than most similar units
- Quieter, smoother operation — lowest blower RPM
- Highest available external static pressures
- Electronic flame failure control
- Completely wired, assembled and flame-tested at the factory to guarantee peak performance
- Listing by Underwriters' Laboratories, Inc. and approved by American Gas Association

Write today for complete information and specifications

ASK FOR BULLETIN H

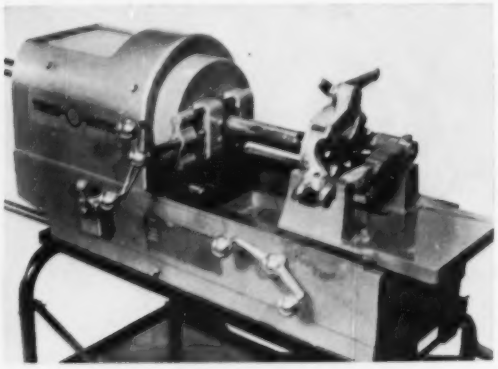
Teardrop design Combustion Chamber the "heart" of National Champions

NATIONAL HEATER CO., INC.
2180 Cleora Ave. St. Paul 4, Minn.

EQUIPMENT DEVELOPMENTS

Continued

system may be used in either new construction or modernization of existing buildings of all sizes, types, says company.



Portable Pipe Threader . . .

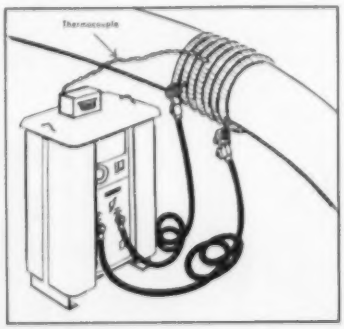
. . . with power-operated double chuck—*Collins Machinery Corp., Dept. HPAC,* 5474 *Alhambra Ave., Los Angeles* 32.

Sliding extension bar makes it easy to break tight fittings, says company. Spindle bearings lubricated by continual feed of oil from individual reservoirs. Includes three quick opening frame die heads with built-in reamers for threading ½ to 2 in. pipe.

Soldering, Brazing Torch . . .

. . . with form-fitting wooden handle—*Huber Industries, Inc., Dept. HPAC,* 4966 *Hillside Ave., Cincinnati* 33.

Model "A" has nine different tips, is of brass except for stainless steel conical valve stem, wooden handle. Designed for maintenance men, industry in general. Requires no pumping or generating, says company.



Heating Element . . .

. . . designed to make preheating or stress relieving pipe welds easier, less expensive more precise—*Arcos Corp., Dept. HPAC,* 1500 *S. 50th St., Philadelphia.*

Cited feature of electrical resistance "Heat-O-Coil" is length of small diameter resistance wire. Full length of wire, except for several inches on each end, is strung with ceramic ball and socket beads. Each end

SKIDMORE PUMPS — *set the pace in performance**

Featuring—mechanical shaft seal

dependable performance

quiet operation

NEW BULLETIN NO. 21-B

send for your copy

Make sure you get all the advantages when you buy or specify heating pumps. The new SKIDMORE type CVS condensate pump offers the very last word in pump engineering—*Mechanical shaft seal . . . greater range of discharge pressures. Compact design . . . lightweight construction . . . quiet operation and dependable performance.*

TYPE CVS
DUPLEX UNIT

For heavy duty service specify a SKIDMORE CVS duplex unit. Above is shown pump with two floats and switches. Unit is also furnished with one float and mechanical automatic alternator to provide alternating operation of two pumps.

TYPE CVS
SINGLE UNIT

Here are the answers to— your Heating Pump Problems

*SKIDMORE PUMPS have set a standard for performance and dependability since 1921

SKIDMORE CORPORATION
ST. JOSEPH, MICHIGAN

EQUIPMENT DEVELOPMENTS

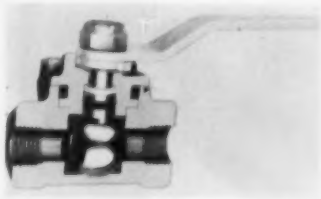
Continued

is formed into small ring. After wrapping coil around welded section of pipe for stress relieving, two ends are connected to terminals. In two standard diameters, lengths. Standard length for ⅛ in. coil, used for large diameter pipe, is 25 ft. Standard length for 1/16 in. coil, for small diameter pipe, is 10 ft.

Tubing Cutter . . .

. . . for copper, brass, aluminum tube from ⅞ in. to 3⅛ in. OD—*Capewell Mfg. Co., Dept. HPAC, 60 Governor St., Hartford, Conn.*

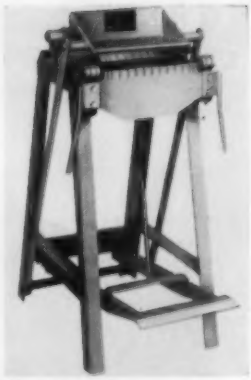
Cuts 3 in. tubing with very little burr, says company. Designed with heat treated tool steel cutting wheel in malleable iron mount, double steel rollers, steel scroll screw with knurled handle, heat treated aluminum alloy body.



Ball Valve . . .

. . . with round opening in ball designed to allow piping to handle fluids with minimum turbulence—*Worcester Valve Co., Inc., Dept. HPAC, 16 Parker, Worcester, Mass.*

Incorporates both "Top-Entry" for easy in-line maintenance, "Twin-Seal" for positive shutoff with flow from either direction. Of forged construction, strength is increased, porosity eliminated, says company. In naval bronze, aluminum bronze, and aluminum to allow variety of media. Repair kit for in-line maintenance available.



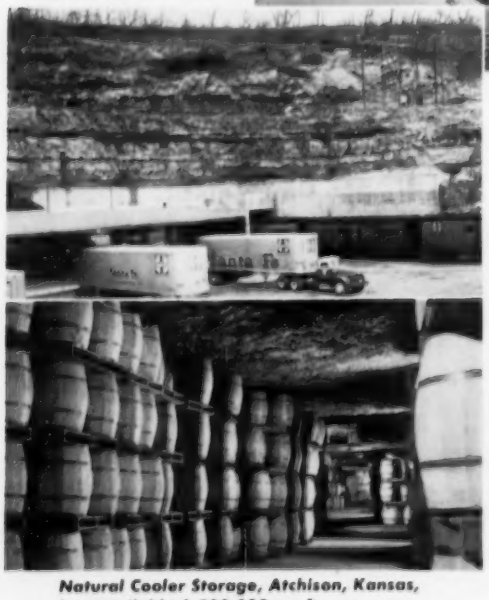
Bending Brake . . .

. . . with slotted jaws to bend folded, seamed strips—*Whitney Metal Tool Co., Dept. HPAC, 110 Forbes St., Rockford, Ill.*

New 12 in. brake specially designed for bending up sheet metal strips on which one or more bent-up edges or seams have been formed. Upper jaw, lower jaw, apron contain matching 3/16 in. slots spaced on 1 in., ½ in. centers. Slots are ¾ in. deep so brake can handle pieces from ½ in. wide to 11 in. wide. Capacity is 20 gage metal.

The Natural Storage, near Kansas City, has ultimate space of 10 million cu. ft.

Below: The Inland Storage, at Kansas City, holds contents of 1500 refrigerator cars.



Natural Cooler Storage, Atchison, Kansas, has available 1,500,000 sq. ft.

FRICK EQUIPMENT
SERVES NATION'S
LARGEST UNDERGROUND STRUCTURES

The trend now is toward underground factories, warehouses, garages, munition plants, hangars, control centers — even offices. Construction costs have proved surprisingly low.

Most of these sub-surface installations require air conditioning, refrigeration, ice making or quick freezing systems.

We have equipped the three largest underground storages in America. (And, of course, thousands of buildings above ground.)

You get the benefit of this unique experience when you consult with Frick Engineers. Ask for Bulletin 416 on this important subject.

Let us quote now on the cooling system you need: write, wire or phone

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DEPENDABLE REFRIGERATION SINCE 1883
WAYNESBORO, PENNA. U.S.A.

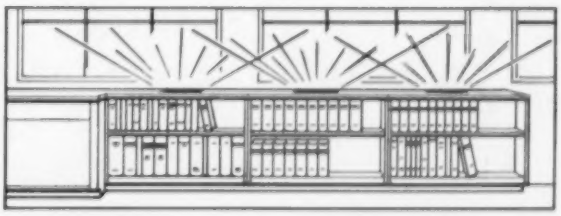
Now you can plan economical classroom comfort with the Norman Schoolroom System

gas-fired forced air heating and ventilating with Util-i-Ducts

The Norman Classroom Package helps keep school construction costs down. It is a completely automatic gas-fired forced air perimeter heating and ventilating system which eliminates the extra cost and space required for a central heating plant. Each room has its own individual heating and ventilating system. Any number of additional classrooms can be added later without expensive revamping as required with a central heating plant.

The exclusive Norman Schoolroom System automatically filters and mixes outdoor air and room air to maintain a healthful and comfortable climate. It automatically compensates for variations in the heating and ventilating requirements caused by changes in occupancy and outside weather conditions. Outside air only is used for combustion.

Util-i-Duct sections are designed to blanket the outside walls with controlled tempered air and also provide handy bookshelf space. Each section has an individual diffuser with damper and adjustable louvers for accurate balancing and uniform distribution. Sections can be extended around the outside walls and under windows — available in standard length sections, corner units and adjustable filler sections to flush in with wall partitions.



Util-i-Duct sections assure proper air distribution for complete classroom comfort and provide bookshelf space.

Norman® products company

Mail the coupon today for full details and specifications

NORMAN PRODUCTS CO.
1150 Chesapeake Ave., Columbus 12, Ohio
Please send me complete information on the Norman gas-fired, forced air Schoolroom Heating and Ventilating System.

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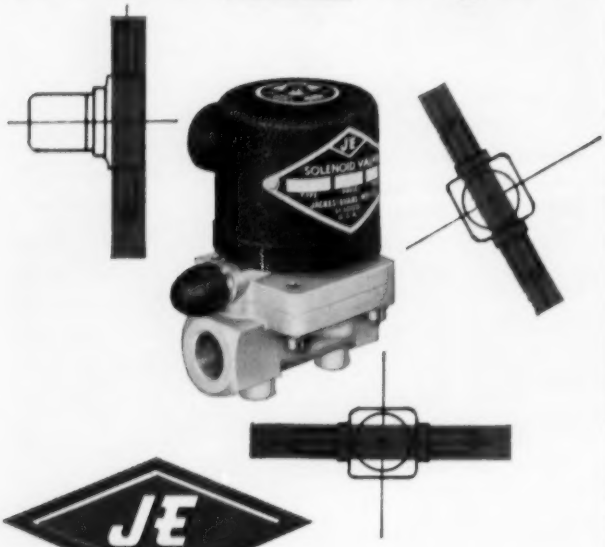
ADDRESS _____

CITY _____ STATE _____

What's Your Angle?



SOLENOID VALVES

*Work perfectly in any position**

You never have to worry about keeping lines horizontal when you install J-E solenoid valves. J-E's advanced design permits the valve to operate perfectly . . . even on a slant of up to 90°. The only requirement is that the coil is not below the valve body.*

- **SIMPLE INSTALLATION** . . . is one reason why more and more installation men are asking their wholesalers for J-E . . . the only solenoid valve that also gives you:
- **QUIET OPERATION** . . . no mechanical linkage or impact action
- **DEPENDABILITY** . . . tight seating, yet no chance for jamming or clogging
- **EASY MAINTENANCE** . . . only two moving parts . . . cool-operating coils . . . one size coil and one plunger to fit all valves

CALL YOUR WHOLESALER . . . or write us today!

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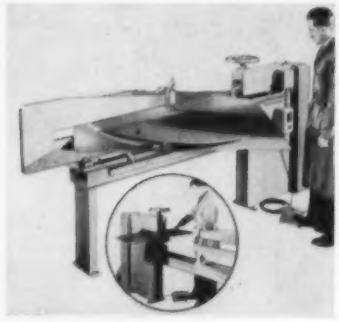
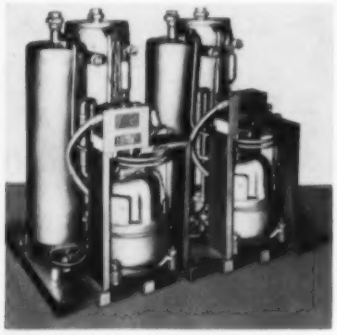


Ring, Circle Shear . . .

. . . with floating circle arm which floats on guided ways to maintain true center "automatically"— *Niagara Machine & Tool Works, Dept. HPAC, 683 Northland Ave., Buffalo* 11.

Center clamp of circle arm adjustable to hold varying thicknesses of material securely, says company. Can be used for cutting straight line work, irregular outlines not requiring sharp curvatures. Capacity is 10 gage mild steel. Cuts circles 6 to 78 in. diameter.



Liquid Chillers . . .

. . . for commercial, industrial applications from 5 to 25 hp—*A. Brown Products Corp., Dept. HPAC,* 97-12 *Metropolitan Ave., Forest Hills, L.I., N.Y.*

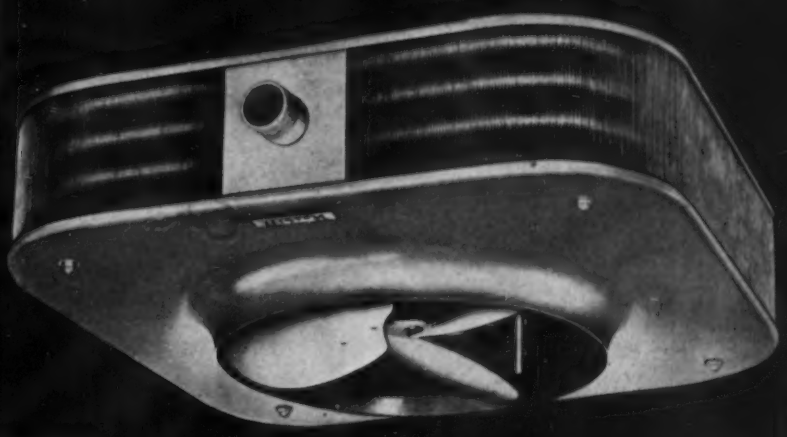
Each 5 ton section shuts itself off as cooling requirements vary or are reduced, says company. Refrigeration mechanism designed to be hermetically sealed, service free, tamperproof.

Submersible Pump Mounting . . .

. . . designed to eliminate need for external lubrication—*ECO Engineering Co., Dept. HPAC,* 12 *New York Ave., Newark* 1.

Featured is teflon adjustable thrust and guide bearing. Fluid pumped acts as lubricant. Type 20 stainless steel construction with chemically inert bearing permits usage in severe corrosive service, says company. In heights to 60 in. from base. Capacities to 45 gpm, heads to 50 ft.

New Design ... New Features



the all new Nesbitt Little Giant unit heaters

One heating element operates on steam or hot water in both vertical and horizontal applications. Wrap-around rectangular construction increases heat transfer area. Opposing headers mean shorter tubes and condensate travel, assuring more even heating on steam systems.

Closer-to-ceiling mounting permitted by side-located piping connections. Motor on all models is removable through botton fan outlet, eliminating the need for access space above the unit. Maximum headroom is assured.

Wide variety of outlets (Adjustable Vane, Cone Deflector, Anemostats and Horizontal- or Vertical-Louvred) simplifies selection of the discharge patterns and mounting heights best suited to the job requirements.

Larger capacity range (34,000 to 684,000 Btu per hour) and smaller physical size permit the economical use of these "propeller fan unit heaters with blower fan performance" in all types of industrial and commercial buildings.

IUHA Rated for Sound and Capacity. All 34 models are sound rated according to today's most reliable basis for judging sound emission. You may now select Little Giants sound coded for the environment they serve.

Little Giant Unit Heaters are tested and rated in accordance with the Standard Test Codes adopted jointly by the Industrial Unit Heater Association and the American Society of Heating and Air Conditioning Engineers.

Send today for Nesbitt Publication 402.

Other Nesbitt Unit Heaters

GIANT UNIT
Pub. 404

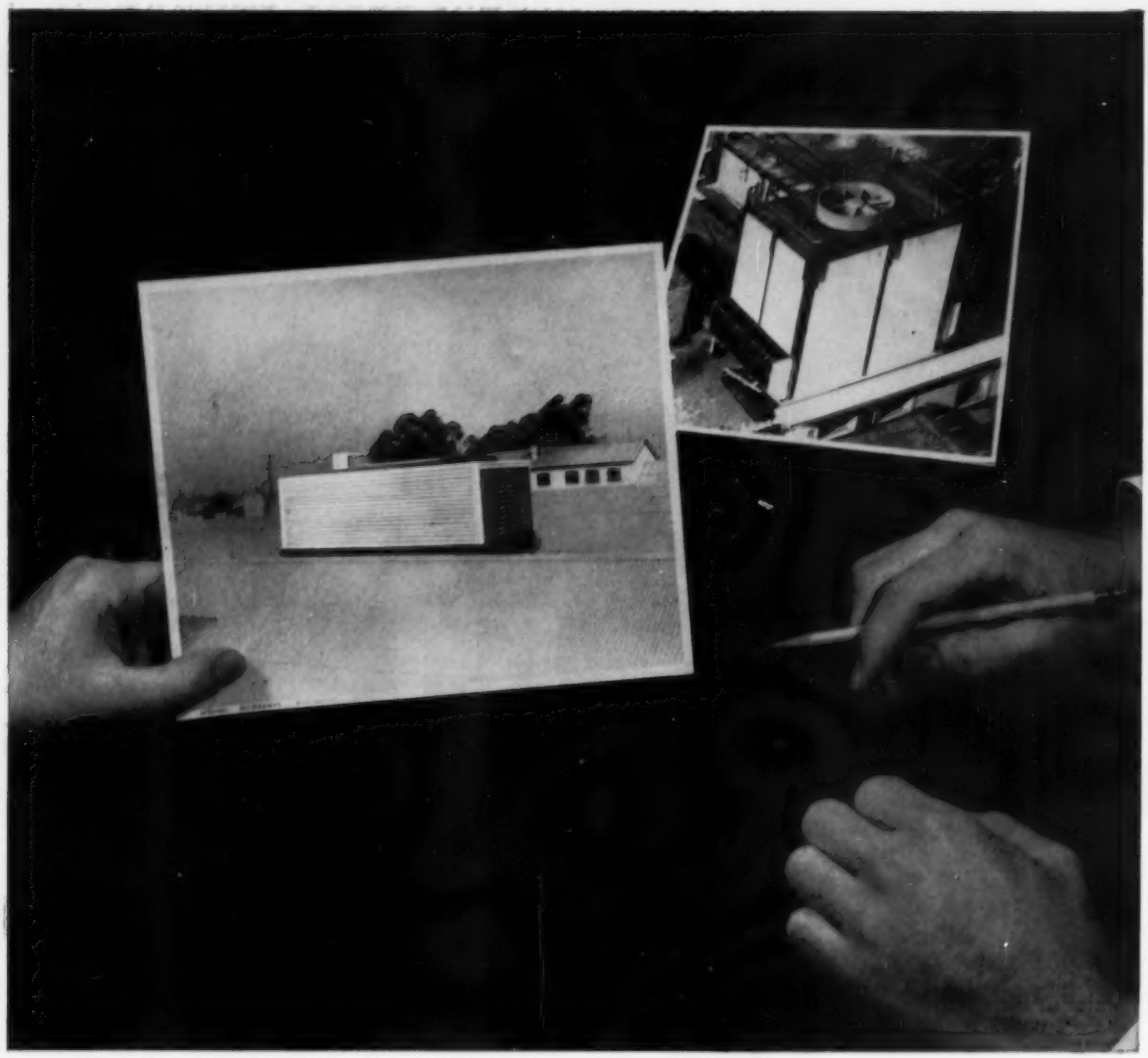
PROPELLER FAN
Pub. 401

GAS-FIRED
Pub. 280

SERIES C
Pub. 403

Nesbitt Unit Heaters are made and sold by
John J. Nesbitt, Inc., Philadelphia 36, Pa.

Nesbitt
LITTLE GIANT UNIT HEATERS



"There's just no comparison! This Pritchard LoLine answers our design problem!"

"When you said it had a low silhouette, you really meant *low!*"

"That's why we chose this Pritchard LoLine tower. You know, cooling towers have always been a problem to architects. We design a good looking building and then have to clutter up the design by putting a tall and unsightly tower on top of it."

"Well, this LoLine ought to make you fellows happy!"

"It makes everyone happy. The engineers like it because it's efficient, has an internal piping system and a performance record that can't be beat. The owners of the building are happy because of the low initial costs and the minimum maintenance."

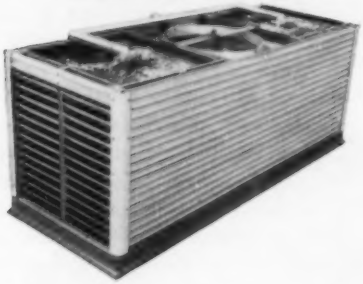
"It looks like the Pritchard LoLine is the answer to a lot of cooling tower problems."

"It is! Whenever there's a problem, you can always count on Pritchard to come up with an answer!"

J. F. PRITCHARD & CO. OF CALIFORNIA
4625 Roanoke Parkway, Kansas City 12, Mo.

"There's just no comparison! This Pritchard LoLine answers our design problem!"

Seven good reasons for choosing the LOLINE®



Pritchard LoLine Cooling Towers are better in seven important ways:

1. They have the lowest silhouette of any tower 75 tons and up. Over-all height is just 7' 7 11/16".
2. *Galvanized* steel fan drive supports and basin accessories; not cheap, less durable, painted steel.
3. Grease fittings for the V-belt drive bearings are brought to the outside of the tower. Greater safety, easier maintenance.
4. *Corrugated* asbestos cement board casing; not flat asbestos cement board sheets.
5. Asbestos cement board louvers are installed as standard, not special equipment.
6. Optional internal pipe supply system. Permits complete concealment of piping.
7. V-belt drive features a stainless steel fan shaft for far longer life.

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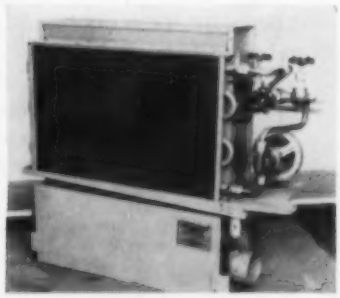
REPRESENTATIVES IN PRINCIPAL CITIES FROM COAST TO COAST

EQUIPMENT DEVELOPMENTS

(Continued)



Valve Cluster . . .

. . . for use with company's induction circulators — *Worthington Corp., Dept. HPAC, Harrison, N. J.*

Is said to eliminate intricate layout of piping connections. Permits left or right hand connections of coil by rotating two main connections 180 deg. Combines inlet, outlet stop valves, bypass valve in one casting for installation on induction circulators used on high pressure induction systems, says company. Available for use with pneumatic control valves, manual control valves, self operating type automatic control valves.

Condenser Cleaning . . .

. . . tool for operation by either air or water pressure—*Crane Packing Co., Dept. HPAC, 6400 Oakton St., Morton Grove, Ill.*

Utilizing gun-and-slug method, gun is lightweight rugged duty tool weighing only 2¾ lb, says company. Available with spool-type slugs for normal slime removal, bullet-shaped slugs for removing heavier slime, scraper-type slugs to cut away scale, mineral deposits. Latter two have jet action holes in side wall to admit water or air for flushing away deposits. Effective pressures range 50 to 200 psi.

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Write for Bulletin No. 6

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Very sensitive.—Diaphragm Operated
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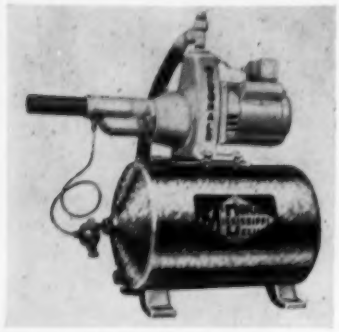
EQUIPMENT DEVELOPMENTS

Continued



Convertible Jet Pumps . . .

. . . designed to use capacitor type, drip-proof, standard ball bearing motors with built-in overload protection—*A. Y. McDonald Mfg. Co., Dept. HPAC, Dubuque, Iowa.*

Single phase 115 volt on 1/3 hp models. Dual voltage, 115/230 on ½ hp models. Furnished with three different jet body assemblies for varying well depths. With top-mounted 6 gal tanks; mounted on 10, 25 gal tanks, or with 42 gal or larger vertical tanks.

Air Cooled Condensers . . .

. . . with two fan belts driven from single motor—*Kramer Trenton Co., Dept. HPAC, N. Olden & Breunig Aves., Trenton 5, N.J.*

Remote-type "Unicon" condenser features low operating noise level, factory assembly, says company. For installations beyond 200 tons.

Tube Piercing Valve . . .

. . . for larger sized tubing—*Madden Brass Products Co., Dept. HPAC, Aurora, Ill.*

"HP-68" features one piece brass body made from extruded bar, recessed sealing gasket. "Automatically" centers tube for piercing, sealing, says company. Pierces 3/8, 7/16, ½ in. OD tube.

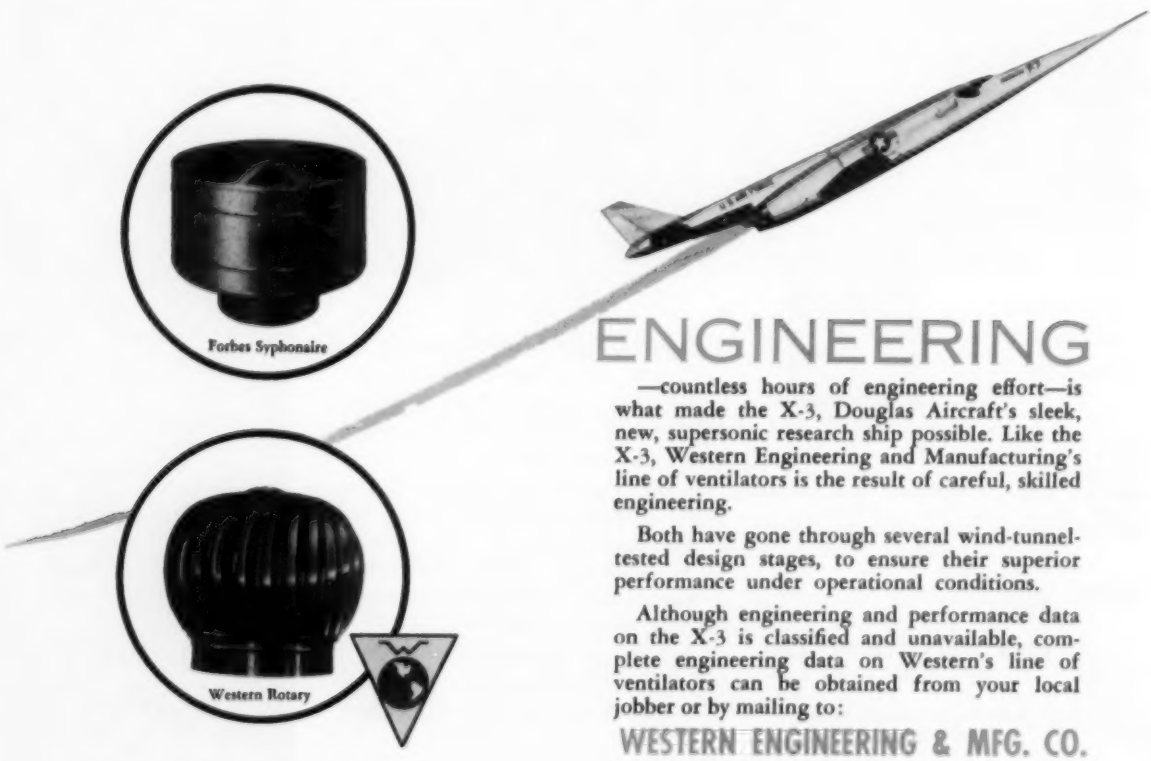
Time Switch . . .

. . . with "weather reset" feature—*Automatic Devices Co., Inc., Dept. HPAC, 714 Hillgrove Ave., Western Springs, Ill.*

Double-switch "Weather-Chron" regulator affected by changes in outdoor weather conditions, which change starting time of heating in morning and change length of morning build-up period so that space temperatures are brought up to daytime selected level at selected time, says company. Another feature is said to eliminate night set-back at preselected low outdoor temperature.

Flexible Hose . . .

. . . for industrial, commercial uses where working pressures are 120 psi or less—*Techniflex Div., Dept. HPAC, Port Jervis, N. Y.*



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—countless hours of engineering effort—is what made the X-3, Douglas Aircraft's sleek, new, supersonic research ship possible. Like the X-3, Western Engineering and Manufacturing's line of ventilators is the result of careful, skilled engineering.

Both have gone through several wind-tunnel-tested design stages, to ensure their superior performance under operational conditions.

Although engineering and performance data on the X-3 is classified and unavailable, complete engineering data on Western's line of ventilators can be obtained from your local jobber or by mailing to:

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Forward Curve wheels offered from 7½ to 73 inch. Capacities up to 70,000 cfm.

Quiet operating, medium speed (IPL) wheels with non-overloading horsepower characteristics for heating, ventilating and air conditioning or industrial applications. Wheel diameters from 15 inch to 73 inch, with any speed or discharge required. Capacities up to 123,000 cfm. Class I, II, or III construction.

All-welded housing featured as standard construction for simplicity, extra strength and rigidity—dust tight and leak proof. Bolted (knock-down) type available in Class I and Class II. Split housing can be furnished as extra if required.

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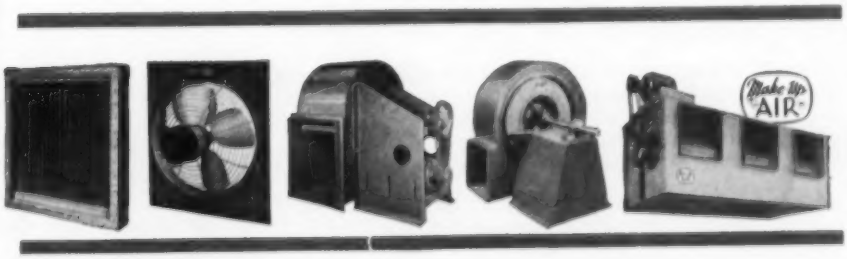

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They are available for straight mounting, 90° back or side angle, incline or recline and multi-angle mounting. Separate sockets and other accessories can also be furnished when specifications require.

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Continued

"Flexco" is seamless brass flexible line designed for conveying steam, oil, water, air, other liquids and gases noncorrosive to copper alloys with 120 lb psi working pressure, 2000 lb burst pressure. Available in ⅜ or ½ in. hose with fitting combinations in lengths from inches to 5 ft.

Fume Hoods . . .

. . . with high corrosion resistance to hydrochloric acid, other fumes normally corrosive to other materials—*Haveg Industries, Inc., Dept. HPAC, 900 Greenbank Rd., Wilmington, Del.*

Polyester resin glass reinforced units are lightweight, have high impact strength, are suited for industrial fume removal applications, says company.

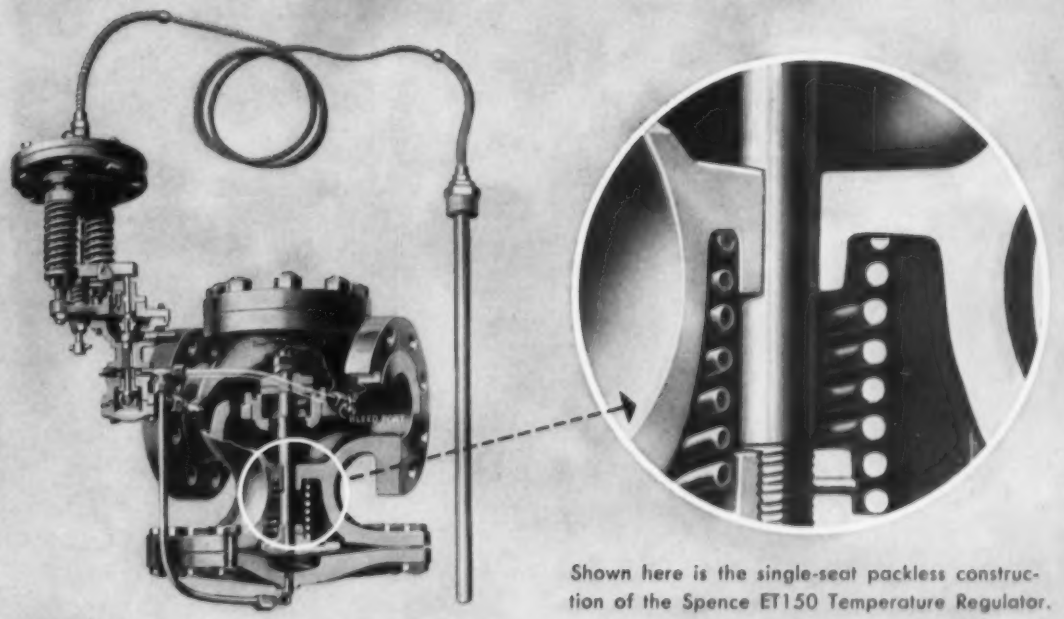
Submersible Pump Motor .

. . . designed for deep well water pumping—*General Electric Co., Dept. HPAC, Schenectady 5, N. Y.*

With water-lubricated bearings. Unit filled with proplyene glycol-water mixture, factory sealed, to keep pressure inside motor greater than outside with aid of spring.

VALVE TIPS:

Advantages of Packless Construction in Temperature Regulating Valves



Shown here is the single-seat packless construction of the Spence ET150 Temperature Regulator.

One of the biggest headaches in regulating valve maintenance is repacking stuffing boxes.

How often a valve needs repacking, how much time it takes, and the cost of the system downtime all vary with the construction of the regulator and the service it's used for. No matter how you calculate all these variables it's still a headache—and an expensive one.

In the temperature regulator shown above (Spence Type ET150) stuffing boxes are eliminated. This is done by what is known as "balanced" diaphragm construction. You can see in the cutaway drawing that pressure is applied to both sides of the large metal diaphragm. The upper side is exposed to delivery steam pressure and the lower side is exposed to loading pressure applied by the pilot. When the pilot closes, both delivery pressure and loading pressure are equalized through the bleedport and connecting tubing.

This construction not only does away with repacking problems, but it makes possible additional savings as well. For example, you will note in the sectional blow-up that this design eliminates a closely fitted stem and guide. Dirt or other foreign matter doesn't have much of a chance to lodge between these parts and cause sticking.

Another cause of binding or sticking, uneven expansion of closely fitted parts, is also eliminated with this design. In addition, valve stem wear is reduced for the same reason.

Lower maintenance is not the only advantage of this packless construction. Accuracy of regulation is also improved because friction due to a stuffing box, dirt, or uneven expansion is not a problem. The large, balanced metal diaphragm is more sensitive to slight changes in pressure.

Guaranteed Not To Wiredraw

If seats and discs are cut by steam (wiredrawn) the loss of steam through these grooves can be another expensive item — directly charged against the regulating valve. Fortunately, you can eliminate these costly leaks by specifying a temperature regulator that is *guaranteed not to wiredraw.*

Spence makes such a guarantee because their seats and discs are made of SECO Metal. Over 20 years experience with this special alloy has failed to produce a single case where a SECO Metal seat or disc had been cut by steam. All that's required is an approved strainer located ahead of the regulating valve. Expensive steam leaks just can't happen with this combination of SECO Metal and single-seat design.

If you would like to have more information on Spence Temperature Regulators, drop us a line and ask for Bulletin T150. It gives more detailed information on these and other Spence design features. Piping layouts and helpful information on the installation of temperature regulators are also included. Write for your copy today.

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W-S 150 lb stainless steel fittings, types 304 and 316, resist a wide variety of corrosive services in petroleum, chemical, petrochemical, food and other process industries. They are also ideal for many low temperature operations because of their inherent toughness at sub-zero conditions. W-S 150 lb fittings can be obtained in sizes ⅛" to 4" in either screwend or socket-welding types to meet your needs.

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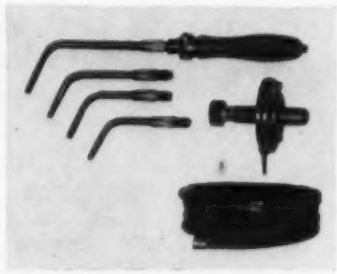
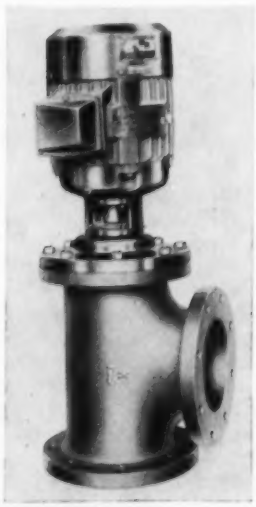
Built of water resistant components. Field windings incased in an epoxy resin.



Soldering, Brazing . . .

. . . torch with "All-Position" poppet valve in handle giving on-off control —*Modern Engineering Co., Dept. HPAC, 3415 Pine Blvd., St. Louis 3.*

Air-acetylene flame produced by "Jiffy" is about 4000 F. Unit has six torch tips. Can be used by air conditioning repairmen for "sweating" solder-type joints on copper pipe.



Brine Agitators . . .

. . . with new centrifugal, vapor seals —*Ruthman Machinery Co., Dept. HPAC, Cincinnati.*

Seals operate on centrifugal principal instead of metal-to-metal or other close contacts. Powered by totally enclosed fan cooled motors permitting continuous operation without endangering motor or bearing life, says company. Available in

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Slash maintenance costs and eliminate costly inspection and lubrication programs with Lima Motors in NEW NEMA frame sizes. With lubricated-for-life DOUBLE-WIDTH ball bearings, solid die cast aluminum rotors with dual integral fans, and Mylar insulation . . . Lima gives you higher full-load speeds with the most complete motor protection available. Install these new Finest Quality Lima Motors—and forget them.

Lima now has in production all ratings in new NEMA frame sizes 182 through 326U. Get complete details on Lima's new NEMA *maintenance-free* motors from your Lima Representative now! If he is not already calling on you, his name and address will be found in *Thomas' Register, MacRae's Blue Book* or *Conover-Mast Purchasing Directory*.

Of course, Lima will continue to produce regular NEMA frame sizes 66 to 505 (⅓ to 150 H.P.), incorporating the latest advances in motor design.

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Open and unprotected motor bearings subject to contamination and must be inspected and lubricated frequently.

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EQUIPMENT DEVELOPMENTS

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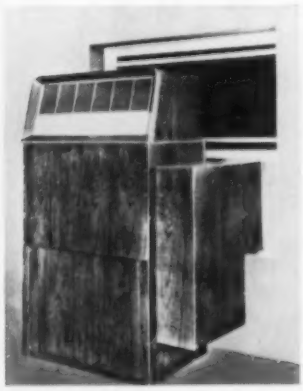
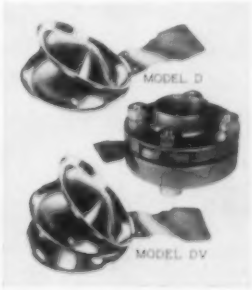
¾ to 3 hp at 1200 rpm; capacities 330 to 2000 gpm at low pressure heads; in pipe sizes 6 to 12 in.



Air Conditioner . . .

. . . for direct window or outside wall installation—*General Air Conditioning Corp., Dept. HPAC,* 4542 *E. Dunham St., Los Angeles* 23.

With air distribution head in natural wood-grain finish. Model "RO-525A" available in 5 ton size.



Rupture Discs . . .

. . . designed to extend advantage of safety head protection—*Black, Sivalls & Bryson, Inc., Dept. HPAC,* 7500 *E.* 12*th St., Kansas City* 26, *Mo.*

"D" and "DV" discs made from thin ductile metals selected on basis of operating requirements. Operate under pressure, temperature, corrosive conditions too severe for conventional types, says company.

Shutoff Valve . . .

. . . with back-seating for repacking under pressure—*Cyrus Shank Co., Dept. HPAC,* 4646 *W.* 12*th Place, Chicago* 50.

Includes swivel, self-aligning seat

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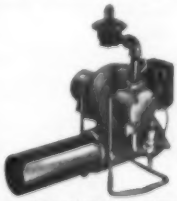
In contrast, the Lo-BLAST Power Gas Burner does not depend upon natural draft, but upon air supplied by a small, *quiet* blower. It provides combustion air *only when the burner is on!* When the burner shuts off, only enough air for pilot combustion is admitted. The heating plant retains much of its heat between operating cycles.

That's why Lo-BLAST Burners average 10% less in operating cost. Capacities of 75,000 to 20,000,000 BTU give complete coverage of residential, commercial and industrial fields.



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The residential Lo-BLAST Burner—capacities 75,000—500,000 BTU.

Send today for complete information on the Lo-BLAST Power Gas Burner

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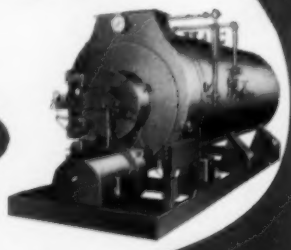
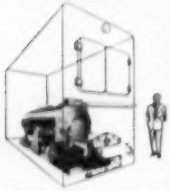


like a TRANSISTOR?

...They both eliminate useless bulk

COMPACT—that's the word for today's radio, with modern transistor tubes replacing the big tubes of earlier days. And Cyclotherm, too,—the modern steam and hot water generator—is a case history in the elimination of useless bulk.



Saving up to one-third the space required by the ordinary boiler, Cyclotherm's exclusive, patented Principle of Combustion and Heat Transfer gives more horsepower per unit of weight, uniform heat transfer for every square foot of heating surface. Guaranteed to operate at a minimum of 80% efficiency, Cyclotherm gets more out of the fuel it burns, gives you substantial savings in gas or oil and in maintenance.

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of soft metal alloy; ample ports, well proportioned hand wheels, says company. Available in both glove, angle types; pipe sizes 1¼, 1½, 2, 2½ in.

Instrument . . .

. . . for testing air velocity, static pressure—*F. W. Dwyer Mfg. Co., Dept. HPAC, P. O. Box 373, Michigan City, Ind.*

Readings of gage are direct, require no reference to graphs, tables. Checks velocities 400 to 10,000 fpm, static pressures 0 to 10 in. WG. No moving parts.

Welder, Positioner . . .

. . . engineered for automatic welding on circular shapes such as rolls, idlers, sheaves, crusher rolls, etc.—*Sight Feed Generator Co., Dept. HPAC, 38 E. Third St., West Alexandria, Ohio.*

"Rexarc RP-43" controls welding operations, rotates work pieces simultaneously with stopping and starting of arc, says company. Voltmeter,

SILENCE

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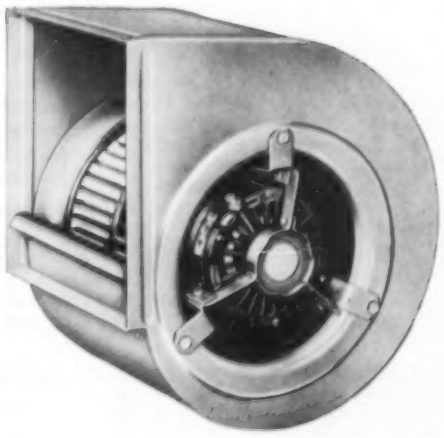
GOLDEN

But perhaps you've heard about it! These days, it's difficult to keep a good thing quiet, unless of course the good thing happens to be Utility's Direct Drive Blower. This silent partner of maximum airflow is equipped with Neoprene hubs which isolate motor noise and vibration. Adaptable to the manufacture of heating, cooling, refrigeration and ventilating equipment, Direct Drive Blowers are designed by Utility engineers to keep things quiet, to make this equipment easier to sell to your customers.

Why not whisper this interesting news to your suppliers. If they'll listen to reason — and that's about the only thing they'll hear with Utility's Direct Drive Blower — you'll easily sell them on the money-making idea that silence is golden — for them and for you.

There's a lot more to the Utility story that also doesn't meet the ear. Utility Direct Drive Blowers take less space, have no unnecessary accessories and can be speed controlled easily. And while Utility's techniques are advanced, costs are not.

Get the maximum sales appeal of silent operation in the equipment you handle. Always check to see that Utility's no-noise Direct Drive Blowers are part of this equipment. Cash in on this "hush-money" with every unit you sell.



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Citizens and Southern National Bank building, Atlanta, Ga. Before (left) and after installation of KoolShade Sunscreen.

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DECORATES AS IT COOLS

By guarding windows against the sun's hot rays, KoolShade Sunscreen reduces cooling needs, saves air conditioning dollars. This benefit has been known for years.

But now comes proof of a new advantage. Today's KoolShade *decorates* as it cools! As installations like the one above show, buildings *look* better with KoolShade.

And see what KoolShade *does*. Used with air conditioning, it minimizes load, more than repays its cost in initial tonnage alone. Used independently, KoolShade keeps rooms up to 15° cooler, offers many benefits of mechanical cooling itself!

Engineer, contractor or owner-manager, it will pay you to investigate KoolShade. You'll feel and *see* the difference.

Only KoolShade gives you all this

- **unsurpassed shading efficiency**—keeps out up to 87% of the sun's hot rays; 100 sq. ft. of KoolShade cuts cooling load about one ton.
- **80% clear visibility**—admits maximum glare-free light.
- **architectural harmony**—improves building's appearance.
- **virtually no maintenance**—specially-treated metal louvres won't corrode, never need painting.

Send today for the facts. Illustrated technical bulletin available on request. No cost or obligation.

627

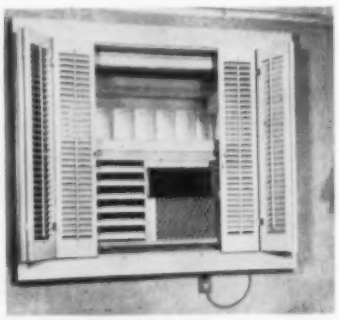
KOOLSHADE Sunscreen BW

REFLECTAL CORPORATION
A subsidiary of Borg-Warner Corp.
310 S. Michigan Ave., Dept. K-5,
Chicago 4, Ill.

EQUIPMENT DEVELOPMENTS

Continued

ammeter indicate welding currents. Has speed range of 0.13 to 1.33 rpm, tilting table for adjustable positioning of rotating shaft.



Movable Shutters . . .

. . . for air conditioners—*Paul Heinley's Movable Shutters, Dept. HPAC, 1620 Euclid St., Santa Monica, Calif.*

Designed for use as cover for front of indoor unit. May be folded back when conditioner is turned on or remain closed with louvers open to allow circulation of air.

Calculator . . .

. . . with heat gain calculation sheet for duct sizing—*Armstrong Furnace Co., Dept. HPAC, 851 W. Third Ave., Columbus 8, Ohio.*

Manual gives explanation of how to use calculator, explains how to make heat gain calculation.

Equipment Briefs . . .

EXPANSION DRIVE RIVET for fastening to masonry—*Southco Div., South Chester Corp., Dept. HPAC, Lester, Pa.* Designed for quick, easy installation. Placed through part to be fastened, into ¼ in. diameter hole, rivets secured by hitting pin with hammer. Pin expands shank of rivet.

WRENCH designed for "automatic" adjustment—*BMS Enterprise Corp., Dept. HPAC, 5512 Dyer St., Dallas.* Adjusted by light pressure on adjustable button on handle. With forged aluminum handle, steel lower jaws, insert steel lip. In 6, 8, 10, 12 in. sizes.

EQUIPMENT DEVELOPMENTS

Continued

TEMPERATURE CONTROLS engineered for improved performance, extensive application uses—*Metals & Controls Corp., Spencer Thermostat Div., Dept. HPAC, Attleboro, Mass.* Cited applications for "Klixon 202" series thermostat are on central heating equipment, air conditioners, ventilators.

MASONRY DRILLS for drilling through concrete, brick, marble, granite, stone, tile, plaster, asphalt, plastics, asbestos, wallboard, reinforcing steel, etc.—*Plomb Tool Co., Dept. HPAC, Los Angeles.* Eleven tungsten carbide-tipped drills added to "Proto" line. Available in core, solid cutter types.

SWITCH designed small in size, rated for 20 amps at 125 volts—*McGill Mfg. Co., Dept. HPAC, Valparaiso, Ind.* Single pole, single circuit unit is said to control to 2500 watts safely on heaters, motors, similar equipment.

THREADED STEEL BARS with zinc plate finish—*Redi-Bolt, Inc., Dept. HPAC, 5334 Indianapolis Blvd., East Chicago, Ind.* New electro plated finish offered in addition to standard blue rust resistant finish. In 10 sizes 3/16 to 1 in., in lengths 24 and 36 in.

MOTOR WINDING THERMOSTAT for large polyphase motors—*Metals & Controls Corp., Spencer Thermostat Div., Dept. HPAC, Attleboro, Mass.* Used to interrupt magnetic starter where temperature build-up is not recognized by overload relay.

PORTABLE DRAFTING MACHINE designed for in-the-field routine sketching—*David Miller & Assoc., Dept. HPAC, P.O. Box 572, Beverly Hills, Calif.* Pocket-sized unit can cover area of 11 × 17 in. Scales calibrated to 0.0005 in. Clamps to drawing board, sketch pad. ⋕

DRIVE-IT® 330

CARTRIDGE-POWERED STUD DRIVER

SAVES TO 80% FASTENING TO CONCRETE OR STEEL

Construction and maintenance men, nationwide, are cutting costs with DRIVE-IT powder-actuated tools. Does 15 minutes work in 15 seconds. Users report time and money savings up to 80% over drilling and other outmoded methods. Electrical, heating and ventilating, plastering, general construction—wherever anything must be fastened to concrete or steel, DRIVE-IT tools are money-makers for their users.

Exclusive DRIVE-IT Advantages

1. ONE POWER LOAD. Only one strength power load needed – whether concrete is soft or hard. No need to buy several strength loads.

2. LIGHTWEIGHT and EASY-OPERATING. The DRIVE-IT 330 weighs less than 6 pounds, is only 13 inches long. One motion opens or closes breech. Automatic cartridge ejection. Trigger-operated.

3. SAFE. Large safety pad plus built-in safety mechanisms protects operator. Tool must be depressed against work surface before trigger can be pressed. Can't be fired accidentally.

4. VERSATILE. Standard ¼-inch barrel can be replaced easily with ⅜-inch barrel for driving larger studs. Uses same low-cost power loads. Over 50 types and sizes of drivepins available.

***DRIVE-IT* Dealers Are Fastening Experts Who Give on the Job Service**

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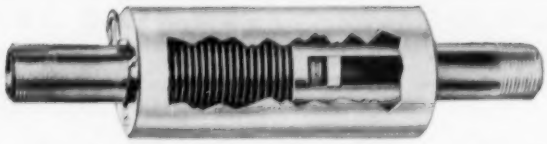
Design Effective Expansion Control into Steam and Hot Water Heating Systems–



Model H, High Pressure Type—for pressures to 150 psig, temperatures to 750°F. Handles total motion to 1¾" (1½" compression, ¼" extension). Available with all commonly used fittings. Pipe sizes: ¾" through 3".

Model L, Low Pressure Type—for pressures to 40 psig, temperatures to 250°F. Handles total motion to ⅝" (½" compression, ⅛" extension). Available with all commonly used fittings. Sizes: ¾" through 2".

with Flexon Expansion Compensators

IMPORTANT DATA ON EXPANSION CONTROL

Heating System Expansion Control Guide

Flexon Expansion Joint Design Guide

For further information, write for these descriptive bulletins.

Expansion Problems in both high and low pressure steam and hot water lines are easily solved by specifying Flexon Expansion Compensators. Use the low pressure unit for horizontal lines—the high pressure type for both risers and horizontal runs.

These units have been especially designed to replace outmoded methods of expansion compensation; slip joints, swing joints, pipe loops and bends become things of the past. The objectionable noise of pipe creeping caused by uncontrolled expansion is eliminated and you are assured of long maintenance-free leakproof service.

Years of actual operating experience in major multi-story projects, in addition to exhaustive laboratory tests, have proved out the quality of design and construction of Flexon Expansion Compensators. You can install "FLEXON" with confidence, knowing they will outlast the life of the piping.

EC-22

FLEXON® QUALITY
proved in service and backed by over 54 years manufacturing experience

Flexonics *Corporation*
EXPANSION JOINT DIVISION
1391 S. THIRD AVENUE, MAYWOOD, ILLINOIS
FORMERLY CHICAGO METAL HOSE CORPORATION
Manufacturers of flexible metal hose and conduit, expansion joints, metallic bellows and assemblies of these components.
In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

RECENT TRADE LITERATURE . . .

▸ *ABRASIVE CUTTING MACHINES* — New bulletin covers features of various "Speed-Cut" abrasive cutting machines. Gives specifications, descriptions, cutting times, other data. *Beaver Pipe Tools, Inc., Dept. HPAC, Warren, O.*

▸ *AIR CONDITIONERS* — New specification sheet for 10, 15 ton packaged air conditioners gives dimensions; lists component parts, accessories, connection sizes. *Worthington Corp., Dept. HPAC, Harrison, N.J.*

▸ *AIR CONDITIONING* — Illustrated bulletin C-R.5625 cites features, gives charts covering dimensions, selection and performance data, full specifications of "Spotaire HRC" air conditioning units designed for commercial, institutional type applications. *Drayer-Hanson, Inc., Dept. HPAC,* 3301 *Medford St., Los Angeles* 63.

▸ *AIR CONDITIONING* — "Incremental System of Air Conditioning for Multi-room Office Buildings" is 24 page book No. 5922 divided into six sections covering general description of system. Contains two amortization tables, conversion factors for various areas per ton, amortization periods range from 5 to 20 years. *Remington Air Conditioning, Div. of Remington Corp., Dept. HPAC, Auburn, N.Y.*

▸ *ALUMINUM SOLDERS* — New folder, "How to use and apply alloys and fluxes for soldering, brazing and welding Aluminum and Aluminum Alloys," includes tables showing old, new type designations; melt, flow temperatures; plastic ranges; strengths for typical aluminums. Similar tables given for five solders suitable for joining aluminum to aluminum, aluminum to dissimilar metals for tensile strengths to 25,000

RECENT TRADE LITERATURE

Continued

psi. *All-State Welding Alloys Co., Inc., Dept. HPAC, 249-55 Ferris Ave., White Plains, N.Y.*

▸ *AUTOMATIC VALVES* — Bulletin G-4 covers features, construction, materials of cushioned automatic valves. Included is brief resume of 11 of firm's line of specialty valves in sizes from 2 in. to 36 in. *Golden-Anderson Valve Specialty Co., Dept. HPAC, 1210 Ridge Ave., Pittsburgh.*

▸ *CENTRIFUGAL FANS* — Bulletins DS-348B and DS-348F, for backwardly inclined blades, forward curved blades, respectively, discuss new features, data on line of class I and class II centrifugal fans. Literature includes auxiliary equipment for special applications. *Trane Co., Dept. HPAC, La Crosse, Wis.*

▸ *CENTRIFUGAL PUMPS* — Bulletin covers line of class "CRV" cradle-mounted centrifugal pumps with capacities 5 to 2800 gpm, pressures of 10 to 525 ft total head. Tabulation of pump types with rating designed to help user select correct unit. Also included are dimensional drawings, typical installation views, performance tables, various modifications available for special applications. *Ingersoll-Rand Co., Dept. HPAC, 11 Broadway, New York 4.*

▸ *CENTRIFUGAL REFRIGERATING MACHINE* — Catalog No. 19C-100 contains tables for selecting right combination of compressor, cooler, condenser in accordance with desired entering, leaving water temperature. Dimensions covering height, length, depth, plus listing of weights, included. Mechanical features of machine graphically outlined. Cutaway drawings show key parts. *Carrier Corp., Dept. HPAC, Syracuse 1, N.Y.*

▸ *CHEMICAL, CORROSION RESISTANT PLASTIC, RUBBER PIPE, FITTINGS, VALVES, LININGS, UTENSILS, COVERINGS* — Bulletins, by number, cover the fol-

ELBOW OUTLET AND 45° BRANCH CONNECTIONS THREADED AND SOCKET-WELD ENDS
APPLICATIONS: DIRECTIONAL FLOW BRANCHES, THERMOWELL CONNECTIONS, PIPE SUPPORT AND HANGER CONNECTIONS
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RECENT TRADE LITERATURE

Continued

lowing: 80-A, "Ace-ite" corrosion-resistant plastic pipe, fittings, valves; 96-A, "Ace Tempron®" hard rubber pipe, fittings; CE-54, utensils for handling corrosive solutions; CE-51, hard rubber pipe, fittings; CE-52, rubber lined pipe fittings and valves; CE-53, rubber and plastic linings, coverings for tanks, other processing equipment. *American Hard Rubber Co., Dept. HPAC, 93 Worth St., New York 13.*

▸ *CONDENSING UNIT* — New three piece literature unit describes two "Copelametic" motor-compressors, new condensing unit for air conditioning, high temperature applications. Two of three provide specifications, performance data for new 3, 10 hp, fluorinated hydrocarbon refrigerant (No. 22), suction-gas cooled motor-compressors; third describes 10 hp remote condensing unit. *Copeland Refrigeration Corp., Dept. HPAC, Sidney, O.*

▸ *CONTROL, TESTER* — Reprint of article details new system for combustion control in boilers, or for controlling flow of gases and liquids. Also, form No. SP-2 covers company's "Shurproof" tester designed for checking burner controls, accessories. *Scully Signal Co., Dept. HPAC, Melrose, Mass.*

▸ *COOLING, HEATING UNITS* — New brochure C-R.5632 features meat cutting room air conditioner with range 500 to 1750 cfm, making it also applicable to candy and confection trades. Literature includes construction, performance data. Cited features such as cleanable air filters, draftless air distribution, large access doors discussed. *Drayer Hanson, Inc., Dept. HPAC, 3301 Medford St., Los Angeles 63.*

▸ *COOLING TOWERS* — New 12 page catalog gives information, specifications on company's line of packaged cooling towers. Included are dimensions, capacity tables, en-

RECENT TRADE LITERATURE

Continued

gineering data, illustrated descriptive material. Typical installations illustrated. *Dover Mfg. Co., Dept. HPAC, 3117 Weatherford Ave., Independence, Mo.*

▸ *DEAERATING HEATER* — Technical reprint T-149 discusses reasons why shop-built deaerating heating was developed, covers details of construction. Includes information on sizes, dimensions, space requirements. *Graver Water Conditioning Co., Dept. HPAC, 216 W. 14th St., New York 11.*

▸ *ELECTRODES* — New "Weldirectory for Mild Steel and Low-Alloy High-Tensile Steels" (SB-1351) revised to include new iron powder, other electrodes. Provides description of each electrode, its physical properties, chemical composition, recommended welding procedures, operator's reference table, list of typical applications. *Lincoln Electric Co., Dept. HPAC, 22801 St. Clair Ave., Cleveland 17.*

▸ *EVAPORATIVE CONDENSERS* — New 12 page catalog on "MC" heavy duty evaporative condensers covers 22 sizes, from 10 to 350 tons, for fluorinated hydrocarbon refrigerants (Nos. 12 and 22), ammonia. Construction, components of units described in detail. Selection data, dimensional drawings, photographs included. *Baltimore Aircoil Co., Inc., Dept. HPAC, 2615 Mathews St., Baltimore 18.*

▸ *EXPLOSIONPROOF MOTORS* — Bulletin GEA-6341, eight pages, discusses design features, maintenance of new "Tri-Clad 55" induction motors — one through 30 hp for use in hazardous locations. *General Electric Co., Dept. HPAC, Schnectady 5, N.Y.*

▸ *FLEXIBLE SHAFTING* — New 12 page engineering bulletin 570 contains information on selecting flexible shafting, illustrates typical

the BEST air for ventilation is INSIDE air!

Traditionally, ventilation calls for large amounts of *outside* air.

Continuous heating or cooling of outside air hikes operating costs . . an expense no longer necessary. Further, in many localities smog or other pollutants make outside air unfit for ventilation.

The inside air you throw away is usually better than new outside air!

How to utilize inside air to best advantage? The practical, modern method is Air Recovery with Activated Charcoal "FilterFolds".

Activated Charcoal FilterFolds in the duct work provide several important benefits. First, they purify outside air of smog and other common pollutants. It's like putting a gas mask on your building. Second, FilterFolds allow you to recirculate up to 100% inside air yet maintain adequate ventilation. The savings in heating or cooling can run as high as 35%. At the same time, stuffiness, tobacco smells, and other odors are removed by the charcoal, resulting in better employee alertness and well-being.

Barnebey-Cheney FilterFolds are easy to install in new or existing duct work . . can be used in any multiples. Plan now to utilize this modern method in your next job.

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"BUFFALO" BOILER FEED PUMPS

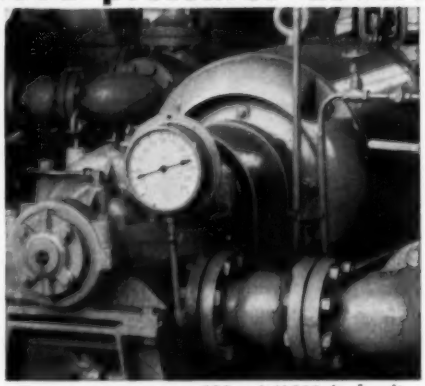
HUSKY...

to keep water pressures up — blood pressures down!

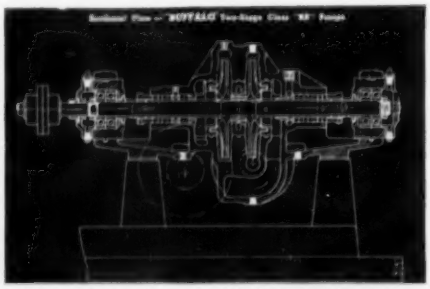
"Buffalo" Type RR 2- and 4-stage Pumps are doing just this important job in boiler installations all over the country—dependably and efficiently—many against heads up to 1500 feet!

That's because they're built up to the job. Impellers, shafts, couplings and casings are heavy-duty. Oversize ball bearings support both ends of the shaft. Stuffing boxes are extra deep, to hold seven rings of packing. In fact, everything about these pumps is oversize except the price. Yes, they will give "extra-long life" delivering cheap gallons on a worry-free basis. Write for Bulletin 980-C for full details on the "Q" Factor* that makes these pumps your best boiler feed buy.

**The "Q" Factor — the built-in Quality that provides trouble-free satisfaction and long life.*



For pressures up to 500 psi (1500 ft. head) — capacities up to 900 GPM.



Note relative large size of shaft and bearings as shown by the above sectional drawing of a "BUFFALO" 2-stage Type RR Pump.

"Buffalo" PUMPS

BUFFALO PUMPS

DIVISION OF BUFFALO FORGE CO.

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Canada Pumps, Ltd., Kitchener, Ont.

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A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

RECENT TRADE LITERATURE

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installations, furnishes information on all sizes from 1/8 to 15/8 in. in diameter for either power drive or remote control applications. *Stow Mfg. Co., Dept. HPAC, 350 Shear St., Binghamton, N.Y.*

▸ *FRACTIONAL, INTEGRAL HP MOTORS* — Condensed catalog includes dimensional drawings, specifications for company's general purpose fractional and integral horsepower motors. Compares old NEMA frames with rerated NEMA frames in cross reference. *Marathon Electric Mfg. Corp., Dept. HPAC, Wausau, Wis.*

▸ *GAS HEATING EQUIPMENT* — Catalog GN-56 covers line of gas-fired commercial, industrial heating equipment. Includes specifications, construction details, dimensional drawings and tables, installation information, application ideas. *Reznor Mfg. Co., Dept. HPAC, Mercer, Pa.*

▸ *GAS PRESSURE SWITCH* — Specification S1011-1 describes new industrial gas pressure switch designed for use on multiple burner gas installations. *Minneapolis-Honeywell Regulator Co., Dept. HPAC, Wayne and Windrim Aves., Philadelphia 44.*

▸ *GEARMOTORS* — New bulletin No. 1880 presents various types of "Syncrogear" motors with list ratings 1/3 to 30 hp, gear ratios to 10:1. Literature discusses application of elliptoidal helical gears and chart graphing degrees of tempering, hardening of gear teeth. *U. S. Electrical Motors, Inc., Dept. HPAC, P. O. Box 2058, Los Angeles 54.*

▸ *HEAT EXCHANGER, CONDENSER TUBES* — Six page technical folder TB-412 provides information, data on design, maintenance, repair; emphasizes quality, dependability, economy of electric resistance welded carbon steel tubing in applications involving heat transfer. Contains chart outlining hydrostatic test pres-

RECENT TRADE LITERATURE

Continued

sures required for various tube sizes. *Babcock & Wilcox Co., Dept. HPAC, Beaver Falls, Pa.*

▸ *HYDROSTATIC PRESSURE TESTING* — Data card covers internal hydrostatic pressures for testing welded tubing. Includes grade and analysis of tube. *Nikoh Tube Co., Dept. HPAC,* 5000 *Whipple St., Chicago* 32.

▸ *INDUSTRIAL, DECORATIVE PERFORATED METAL* — Catalog No. 62 contains information as to sheet sizes, type and gage of metal for company's industrial and decorative perforated metal sheets. Percent of open area given. Perforated patterns illustrated in actual size. Applications such as concealment for air conditioning or ventilation equipment cited. *Harrington & King Perforating Co., Inc., Dept. HPAC,* 5655 *Fillmore St., Chicago* 44.

▸ *INSTRUMENTS* — Catalog No. 136 contains price list, information on air-meters, vacuum gages, manometer-flowmeters, electronic standard cells, other instruments. *Hastings-Raydist, Inc., Dept. HPAC, Hampton, Virginia.*

▸ *INTEGRALLY FINNED TUBING* — New booklet covers number of applications where "Trufin" tube is used and can be used effectively, economically. Cites applications in industries such as air conditioning, processing, water heater, refrigeration, allied industries. *Wolverine Tube, Div. of Calumet & Hecla, Inc., Dept. HPAC, Guardian Building, Detroit* 26.

▸ *JACKETED VALVES, FITTINGS, PIPING* — Catalog No. 356 contains information on jacketed piping layout, tubing jumpovers, materials, fittings, plug valves, relief valves, jacketed pipe, flexible hose, expansion joints, basket strainers. Illustrations, charts present design, construction data. *Parks-Cramer Co., Dept. HPAC, P. O. Box* 444, *Fitchburg* 17, *Mass.*

▸ *LEAK DETECTOR* — GEC-233F, an 8 page bulletin, describes features, applications, specifications, operation of portable instrument for locating leaks in closed systems. *General Electric Co., Dept. HPAC, Schenectady* 5, *N.Y.*

▸ *LIMIT SWITCHES* — Bulletin No. 5605 contains voltage rating charts, dimensional diagrams, wiring illustrations, application photos, list prices. Instructions for adjusting rotating limit switches with pilot ratings to 480 volts also furnished in the 4 page bulletin. *Furnas Electric Co., Dept. HPAC,* 1041 *W. McKee St., Batavia, Ill.*

▸ *LOW TEMPERATURE BRAZING* — Bulletin No. 73 describes brazing torch, "Easy-Flo" low temperature silver brazing alloy, low temperature "Handy Flux." Cites applications,

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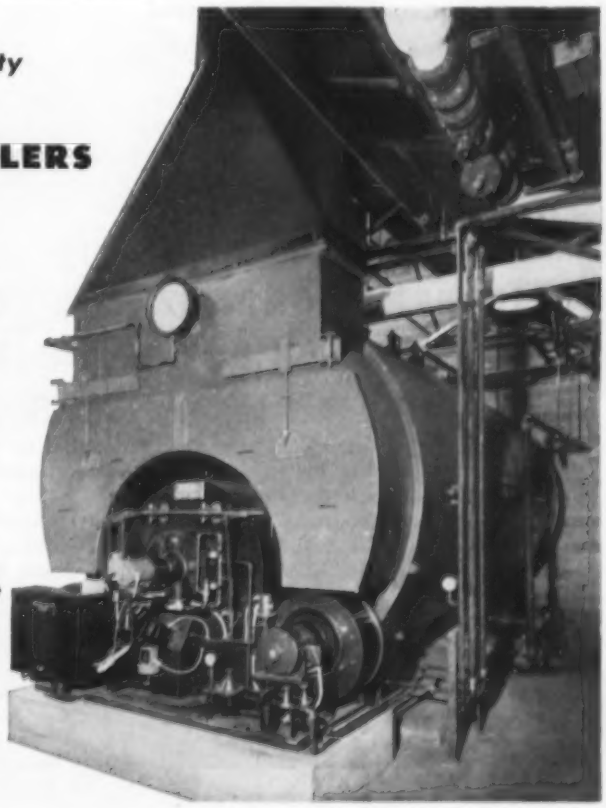
Dependable quality since 1863 . . . . .

POWER BOILERS

Throughout 93 years, Farrar & Trefts has been a leader in boiler design and construction. Today, as in yesteryear, F & T offers dependable, efficient, modern power boilers to satisfy the ever-increasing demands of institutional, apartment, office and industrial buildings. Under the same BISON brand, F & T also furnishes low-pressure boilers for heating purposes.

Proper selection of a boiler for the continuous delivery of required heat and power is a precise project, demanding the systematic approach of engineers long trained in this work. Engineers at F & T have this background of service and they welcome opportunities to evaluate the needs of boiler users.



Standard F & T Super Scot Power Boiler (150 lb. design pressure) with "Indiana Pack" burner at Mastic Asphalt Corp., South Bend, Ind. Furnished by Page Associates of Chicago. The Austin Co. were the Engineers and Contractors.

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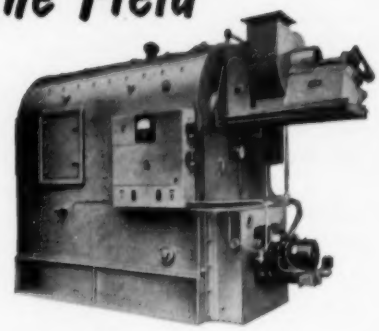

- Ample Furnace Volume—low heat release rates
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- Induced Draft—quiet operation
- Fully Coordinated—fire tested
- Oil, Gas or Combination Firing

Package boilers can also be shipped, less burner and controls, for installation by local contractors in accordance with International's standard package specifications.

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It will pay you to specify International, the boilers with extra profits built in. We will gladly send these International Bulletins:

No. 600 —Water Tube Package Units
No. 200 & 500—Water Tube Heating Boilers
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810 Spruce St. East Stroudsburg, Pa.

RECENT TRADE LITERATURE

Continued

operation, safety features. *Handy & Harman, Dept. HPAC, 82 Fulton St., New York 38.*

▸ *LUBRICATION* — Technical Bulletin No. 43 describes lubrication of air conditioning, refrigeration equipment in two parts. Part one tells what to look for in refrigeration oil; how to determine oil needs of refrigeration compressor. Part two explains refrigeration principles; describes air conditioning, refrigeration equipment. *Sun Oil Co., Ltd., Dept. HPAC, 600 University Ave., Toronto 2, Ont., Canada.*

▸ *MAINTENANCE PRODUCTS, SERVICES* — Booklet PP-4 covers line of products, available services for maintenance of boilers, oil burners, water supply systems, condensers, air conditioning systems. Literature also describes more technical data available concerning individual products covered by booklet. *Perolin Co., Dept. HPAC, 350 Fifth Ave., New York 1.*

▸ *MECHANICAL POWER TRANSMISSION* — Engineering catalog containing 328 pages covers line of mechanical transmission products. Includes sectional drawings, dimensions, weights, prices, application details, engineering tables. *Dodge Mfg. Corp., Dept. HPAC, Mishawaka, Ind.*

▸ *MECHANICAL STUFFING BOX SEALING* — Circular No. 189 includes dimensional drawings, stuffing box temperature chart, design features, spare and replacement parts, parts list. *Dean Brothers Pumps, Inc., Dept. HPAC, 323 W. 10th St., Indianapolis.*

▸ *MECHANICAL TUBING* — New tolerance tables, additional size ranges for square, rectangular, round carbon, stainless steel welded "Electrunite" mechanical tubing described in reference data. Wall, desk, pocket type charts list tube, wall, cut length tolerances for hot, cold rolled car-

RECENT TRADE LITERATURE

Continued

bon, stainless steel tubes in addition to chemical analyses, weight. Physical properties set forth as welded normalized, drawn, mandrel drawn. *Steel and Tubes Div., Republic Steel Corp., Dept. HPAC, 224 East 131st St., Cleveland 8.*

▸ *METAL HOSE* — New 4 page bulletin 955 gives information on bronze hose 1/16 in. to 8 in. ID, diesel exhaust hose 2 in. to 20 in. ID. Illustrations show cross sections of hose, fittings. Tables give technical data. Tabulated service classification serves as aid to writing hose specifications. *Seamlex Co., Inc., Dept. HPAC, 41-23 24th St., Long Island City 1, N.Y.*

▸ *MILLIVOLTMETER MICROAMMETER RECORDER* — Bulletin MG10 contains general dimensions, operating specifications, design specifications, voltage ranges, current ranges, operating features, safety features for "Series 130" recorder. Illustrated brochure also contains tables, charts. *Manning, Maxwell & Moore, Inc., Dept. HPAC, Stratford, Conn.*

▸ *NYLON PIPE* — Brochure discusses features such as: bursting strength, ability to withstand high temperatures, prices competitive with copper, non-toxicity of "Tempertube" nylon pipe. Includes material specifications in chart form. *Danielson Mfg. Co., Dept. HPAC, Danielson, Conn.*

▸ *PACKAGED AIR CONDITIONERS* — New specification sheet, bulletin No. C-1100-S109P, gives features, dimensions, weights, sizes, component parts of 3, 5, 7½ hp packaged air conditioning units. *Worthington Corp., Dept. HPAC, Harrison, N.J.*

▸ *pH AND CONDUCTIVITY RECORDERS, CONTROLLERS* — Catalog 1551 includes information about equipment for measuring, indicating, recording, controlling electro-chemical variables. Fundamentals of electro-chemical instrumentation reviewed. Basic systems described. *Minneapolis-Honeywell Regulator Co., Dept. HPAC, Wayne and Windrim Aves., Philadelphia 44.*

▸ *PIPE, TUBING, DUCTING, VALVES, FITTINGS* — Twelve page catalog illustrates, describes line of corrosion resistant polyethylene, polyvinyl chloride products. Material arranged in reference form. Photos, drawings supplement text. *American Agile Corp., Dept. HPAC, P. O. Box 168, Bedford, Ohio.*

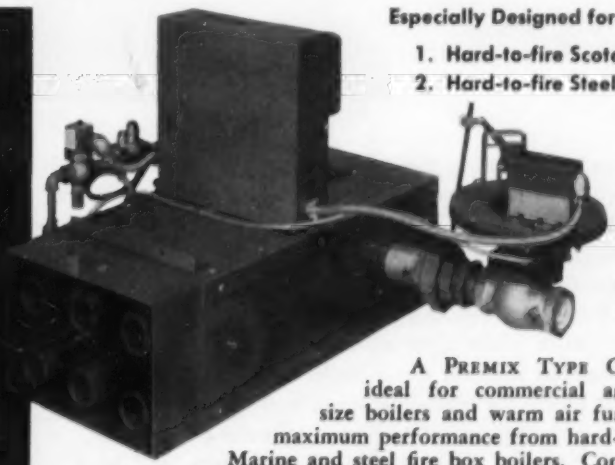
▸ *PLASTICS* — Brochure furnishes information on chemical, electrical, mechanical properties of "Teflon," "Raylon." Provides specifications on various sizes in which sheets, tape, molded and extruded rods and tubes are available. Suggests typical applications. *Raybestos-Manhattan, Inc., Dept. HPAC, Manheim, Pa.*

Especially Engineered to Permit . . .

HIGH FIRING RATES at HIGH EFFICIENCY

MULTURI (MULTIPLE VENTURI) BURNERS

- Formed steel mixers, finished for corrosion resistance, offer minimum resistance to mixture flow, result in uniform high capacity.
- High temperature resisting stainless steel flame retainers insure flame stability over a wide capacity range.
- Mixer design produces a hot clear flame, results in high combustion efficiency with minimum excess air.



Especially Designed for . . .

1. Hard-to-fire Scotch Marine Boilers
2. Hard-to-fire Steel Fire Box Boilers

Multuri Burners available in standard units, 4 to 54 mixers. Capacities 700,000 to 10,800,000 BTU/hr. Higher capacities can be furnished.

A PREMIX TYPE GAS BURNER, ideal for commercial and industrial size boilers and warm air furnaces. Gives maximum performance from hard-to-fire Scotch Marine and steel fire box boilers. Controlled flame characteristics make the burner a natural for units with extensive refractory surface. Suitable for any gas at 4" gas pressure or more. Permits high firing rates at high efficiency. Simple to install, adjust, and operate. Completely Factory Wired and Assembled — Ready for Immediate Installation !

Write for detailed information—or for a questionaire listing all the data necessary for correct specifications and efficient installation.

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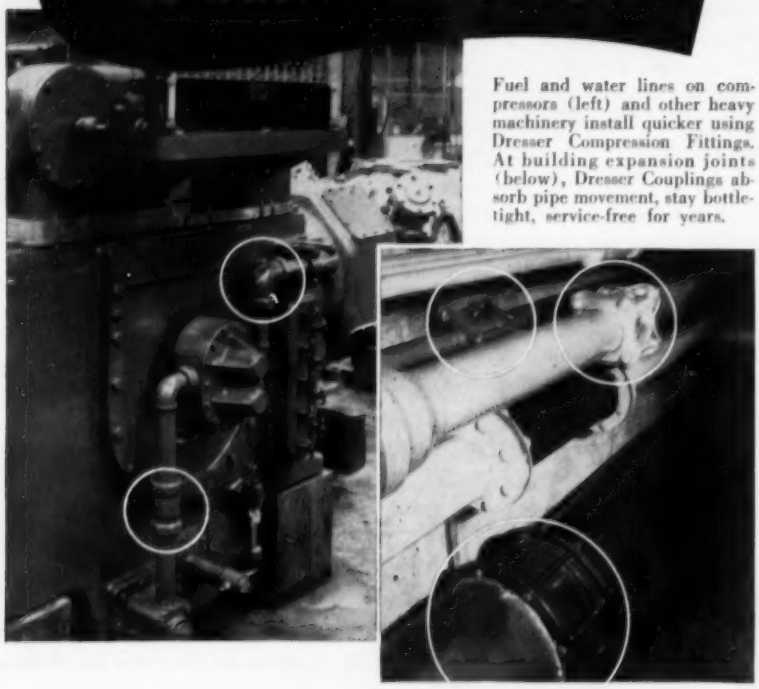
GAS HEATING EQUIPMENT

DEPT. HPAC BUFFALO 6, N. Y.

FURNACES • COOLING UNITS • BOILERS • UNIT HEATERS • GAS BURNERS

FOR IN-PLANT PIPING...
the DRESSER way
is *Easier... Surer!*



Fuel and water lines on compressors (left) and other heavy machinery install quicker using Dresser Compression Fittings. At building expansion joints (below), Dresser Couplings absorb pipe movement, stay bottle-tight, service-free for years.

You're sure of providing the quickest, most trouble-free installations . . . at the lowest possible over-all costs . . . when you use Dresser Style 38 Couplings and Style 65 Compression Fittings!

They eliminate threading, exact pipe fitting, grooving, soldering, flaring and caulking. With Style 65s, for instance, you simply stab plain pipe ends into a factory-assembled unit and tighten the end nuts. Style 38s assure permanent, bottle-tight joints for plain-end steel, cast iron or other pipe . . . wrench-installed in but two man-minutes per bolt.

Style 65 Fittings are available in sizes from ⅜″ to 2″. Style 38 Couplings to 12″ OD and over.

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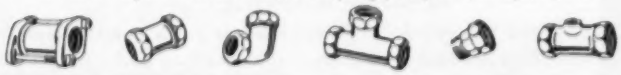
for the complete Dresser line of couplings, ells, tees, adapters, etc.



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ONE OF THE DRESSER INDUSTRIES

Dresser Manufacturing Division, 79 Fisher Ave., Bradford, Pa.

RECENT TRADE LITERATURE

Continued

▸ *PNEUMATIC LEVEL CONTROLLER* — New 32 page bulletin F-4 describes principle of operation of displacement type float, illustrates construction available for applications that can use "Level-Trol" pneumatic level controller. *Fisher Governor Co., Dept. HPAC, Marshalltown, Iowa.*

▸ *POWDER-ACTUATED TOOLS* — Series of diagrams show different ways in which "Ramset" tool can be used such as for acoustical ceilings, steel deck plates, duct straps, electrical junction and switch boxes, etc. *Ramset Fastening System, Dept. HPAC,* 12117 *Berea Rd., Cleveland.*

▸ *POWER TRANSMISSION* — New 12 page brochure describes flexible couplings, variable speed pulleys, transmissions, universal joints, motor bases. Includes operating data, horsepower ratings, sizes and types. *Lovejoy Flexible Coupling Co., Dept. HPAC,* 4800 *W. Lake St., Chicago* 44.

▸ *PROPELLER FANS* — Revised catalog, bulletin A-109B, covers line, contains fan sizes not shown in previous edition as well as revised air deliveries, specifications, performance data, dimensional drawings. *Hartzell Propeller Fan Co., Dept. HPAC, Piqua, Ohio.*

▸ *PUMPING, SEWAGE TREATMENT EQUIPMENT* — Manual 1114 gives information for determining capacities of, selecting vertical wet pit pumps, pneumatic ejectors. Included is table for rating fixture units, curve for estimating pump capacity, table for determining friction of water in pipes. *Yeomans Bros. Co., Dept. HPAC,* 1999 *N. Ruby St., Melrose Park, Ill.*

▸ *REGULATORS* — Revised 12 page version of "1001" regulators (bulletin No. 1059) includes photo-

RECENT TRADE LITERATURE

Continued

illustrated descriptions of 250 lb type high pressure model of "1001" designed for maximum capacity of 200 psi, outlet pressure range 5 to 60 psi. Maximum capacity tables included. *Meter and Valve Div., Rockwell Mfg. Co., Dept. HPAC, 400 N. Lexington Ave., Pittsburgh 8.*

▸ *RELAYS* — Bulletin MRM 240 describes range, switch setting, relay action, relay contact arrangements, optional contacts, action on signal or power failure, design and operating specifications for company's line of relays for high, low limit action. *Manning, Maxwell & Moore, Inc., Dept. HPAC, Stratford, Conn.*

▸ *ROTAMETERS* — Bulletin No. 130, new 12 page brochure, describes, illustrates company's armored rotameters, types of rotameter extensions available. Includes details of design and construction, capacity charts, principles of operation. *Brooks Rotameter Co., Dept. HPAC, Lansdale, Pa.*

▸ *SHOCK, VIBRATION CONTROL* — Bulletin SVC-55 describes various types of machinery vibration. Gives basic data, formulas and graphs enabling reader to recognize problems. Reviews practical methods of shock, vibration control. *T. R. Finn & Co., Inc., Industrial Div., Dept. HPAC, 200 Central Ave., Hawthorne, N.J.*

▸ *SILICONE RUBBER PRODUCTS, COATED CLOTHS* — New 8 page brochure contains specifications, data on properties of silicone rubber, resistance qualities, limitations, service recommendations. *Raybestos-Manhattan, Inc., Dept. HPAC, Passaic, N.J.*

▸ *TEMPERATURE REGULATOR* — Bulletin contains such data as weights and dimensions, pressure and temperature ratings, accessories, construction and performance characteristics, applications, for series "V" self

Introducing a new concept in

style-setting

cost-saving

GAS UNIT HEATERS

- **STEPPED-UP PERFORMANCE** — Improved stainless steel burners . . . choice of stainless or aluminized steel heat exchangers.
- **QUIETER OPERATION** — Lower speed motors. Resilient mountings minimize noise level.
- **WIDER RANGE OF SIZES** — Eight sizes . . . 25,000 to 310,000 Btu. For natural, manufactured, mixed, LP and LP-air gas mixtures.

the Magnificent *Modine*

MODINE held nothing back in creating this magnificent new gas-fired unit heater. Nationally famous designer Jean Otis Reinecke set the style . . . used sparkling, polished chrome, plus a restful gray-green finish to enhance the distinctive modern lines. And Modine engineering held unit weight down to produce a unit heater up to 50% lighter than other makes. This weight reduction means lower shipping costs for you . . . a unit that is definitely easier to handle and easier to install.

GET FULL DETAILS FROM THIS BULLETIN

MODINE MFG. CO.
1509 DeKoven Ave., Racine, Wisconsin

I would like to know more about the new style-setting Modine Gas Unit Heaters. Please send me free Bulletin 656.

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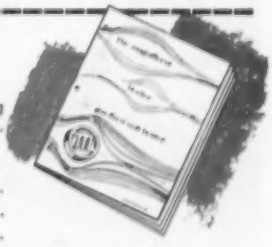
GU-1320



RECENT TRADE LITERATURE

Continued

operating temperature regulator." *A. W. Cash Co., Dept. HPAC, P. O. Box 441, Decatur, Ill.*

▸ *THERMOCOUPLE, RADIATION DETECTORS* — Construction, application of thermocouples, radiation detectors used on industrial control applications discussed in bulletin F-5228-3. Included are standard thermocouple temperature-millivolt equivalents with temperatures expressed on international temperature scale. Electromotive force expressed in absolute units. *Wheelco Instruments Div., Barber-Colman Co., Dept. HPAC, Rockford, Ill.*

▸ *THERMOSTAT BIMETAL* — Six page sheet contains data on new thermostat bimetal "ASC-3" with optimum range 200 to 600 F. Technical data sheet No. A-401 contains engineering specifications, formulas for thermal deflections, load of force, force-temperature, force-deflection, stress of cantilever, U-shape, helical elements. Tables of deflection constants, electrical conductivity included. *Industrial Div., American Silver Co., Dept. HPAC, 36-07 Prince St., Flushing 54, N.Y.*

▸ *TRAY-TYPE DEAERATOR* — Publication 4652 describes design, operation, construction features of deaerator. Bulletin includes dimensional drawings, photographs. *Cochrane Corp., Dept. HPAC, 17th St. below Allegheny, Philadelphia 32.*

▸ *TUBULAR PRODUCTS, FITTINGS, FLANGES* — Technical data card 186 is guide in table form to specifications and applications of tubular products, fittings, flanges in various grades of steel. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC, Beaver Falls, Pa.*

▸ *VALVE STEM PACKINGS* — Bulletin describes two types, (braided of asbestos yarns or plastic) of "custom-made" valve stem packings. Illustrates shapes most commonly used. Lists size limitations. Also provides recommendation chart for standard items when used against various fluids, gases. *Raybestos-Manhattan, Inc., Packing Div., Dept. HPAC, Passaic, N.J.*

▸ *VARIABLE SPEED DRIVES* — New 44 page booklet No. 20P50 includes information on design features, drive principles, horsepower rating tables for A, B, C, D, E, section belts, speed range table showing variation in rpm when using two "Vari-Pitch" sheaves in combination, and accessory equipment for "Vari-Pitch" drive. *Allis-Chalmers Mfg. Co., Dept. HPAC, 1171 S. 70th St., Milwaukee.*

▸ *VARIABLE SPEED TRANSMISSIONS* — Brochure discusses operation, dimensions, specifications, applications of "Maureymatic" variable speed transmissions. Also contains charts giving data on drives, motors, transmissions. *Maurey Mfg. Corp.,*

Power-Flame
GAS CONVERSION BURNERS
and
COMBI-MATIC
Gas-Oil Combination Burners
The Complete Line...
engineered for every industrial, commercial, domestic application
WITH ALL THESE IMPORTANT FEATURES:
● Completely assembled and factory wired
● 100% forced air for complete combustion
● Dimensional design permits installation without heating plant modification
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● A full line—priced right.
Write for complete information and the location of your nearest factory representative
BFG Series—
In capacities from 450,000 BTU to 18,000,000 BTU input. For industrial applications—large capacities for heating, power, or processing.
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3 gun-type units in capacities from 175,000 BTU (AGA listed) to 500,000 BTU. Ideal for all conversion applications, especially for replacement of oil burners.
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COMBI-MATIC burners—forced draft gas-oil—6 models for all gases and light oil in capacities to 2,500,000 BTU input. U.L. listed. Changes over from one fuel to the other with automatic or "built in" manual switch.
Power-Flame BURNER
POWER-FLAME—regardless of application, you can offer your customer a burner that insures years of dependable trouble free service
A Division of Siemon Manufacturing Company—Grandview, Mo.

RECENT TRADE LITERATURE

Continued

Dept. HPAC, 2915 S. Wabash Ave., Chicago 16.

▸ *V-BELT DRIVES* — Bulletins to help users of v-belt drives diagnose many common causes of trouble in drives cover the following: No. 1 tells how to keep v-belt drive delivering maximum rpm. No. 2 deals with v-belt drives using "QD" sheave. Points out how to select proper drives, install drives and belts, keep sheaves in good working order, adjust belts, check motor and driven shaft for alignment. No. 3 illustrates symptoms of v-belt failure, gives diagnoses and cures for troubles. *Worthington Corp., Dept. HPAC, Harrison, N.J.*

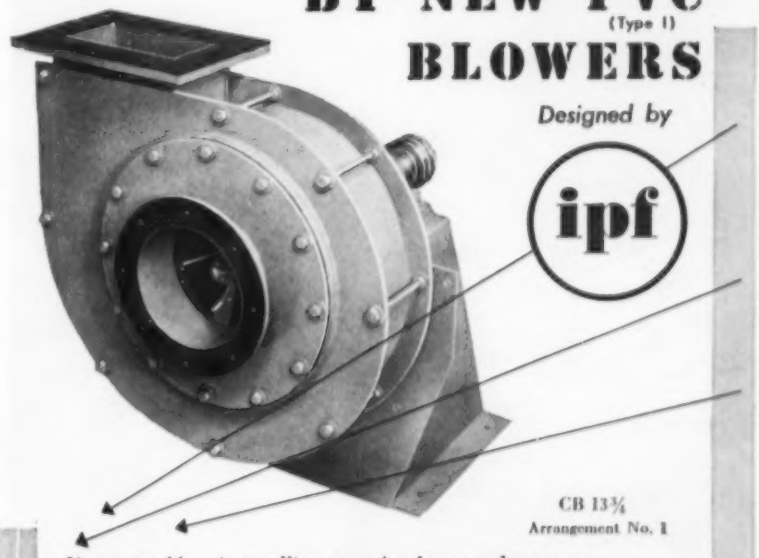
▸ *WATER COOLING UNITS* — Form 9143-B, new 24 page bulletin, gives complete listing of range of sizes available, approximate dimensions, description of component parts, auxiliaries for "Steam-Jet" water cooling units. Diagrammatic illustrations show operation. Includes section on automatic controls. Installation photos show application. *Ingersoll-Rand Co., Dept. HPAC, 11 Broadway, New York 4.*

▸ *WATER FILTERS* — Illustrated 12 page bulletin WC-107A covers uses, design features, engineering details of pressure sand and gravel filters. Details of accessory equipment, types of controls, capacity table, sizes and space requirements included. *Graver Water Conditioning Co., Dept. HPAC, 216 W. 14th St., New York 11.*

▸ *WEATHER CONTROLS* — New 4 page illustrated bulletin describes complete line of outdoor-type automatic heat controls. Classes of controls available are: time switches, set "automatically" by outdoor weather; "Weather-Man" controls, in which outdoor temperatures regulate hours of building heat generation and rate of heat flow; "Indoor-Outdoor" controls, which alter heating system's

OUTMODED BY NEW PVC (Type I) BLOWERS

Designed by ipf



CB 13¾
Arrangement No. 1

If your problem is expelling corrosive fumes and gases, you need IPF Blowers. Ordinary blowers are susceptible to attack by these fumes and gases. Coating the blower is costly — and not foolproof. Maintenance and replacement costs are high . . . and valuable time is lost. Result — an expelling operation that eats into profits.

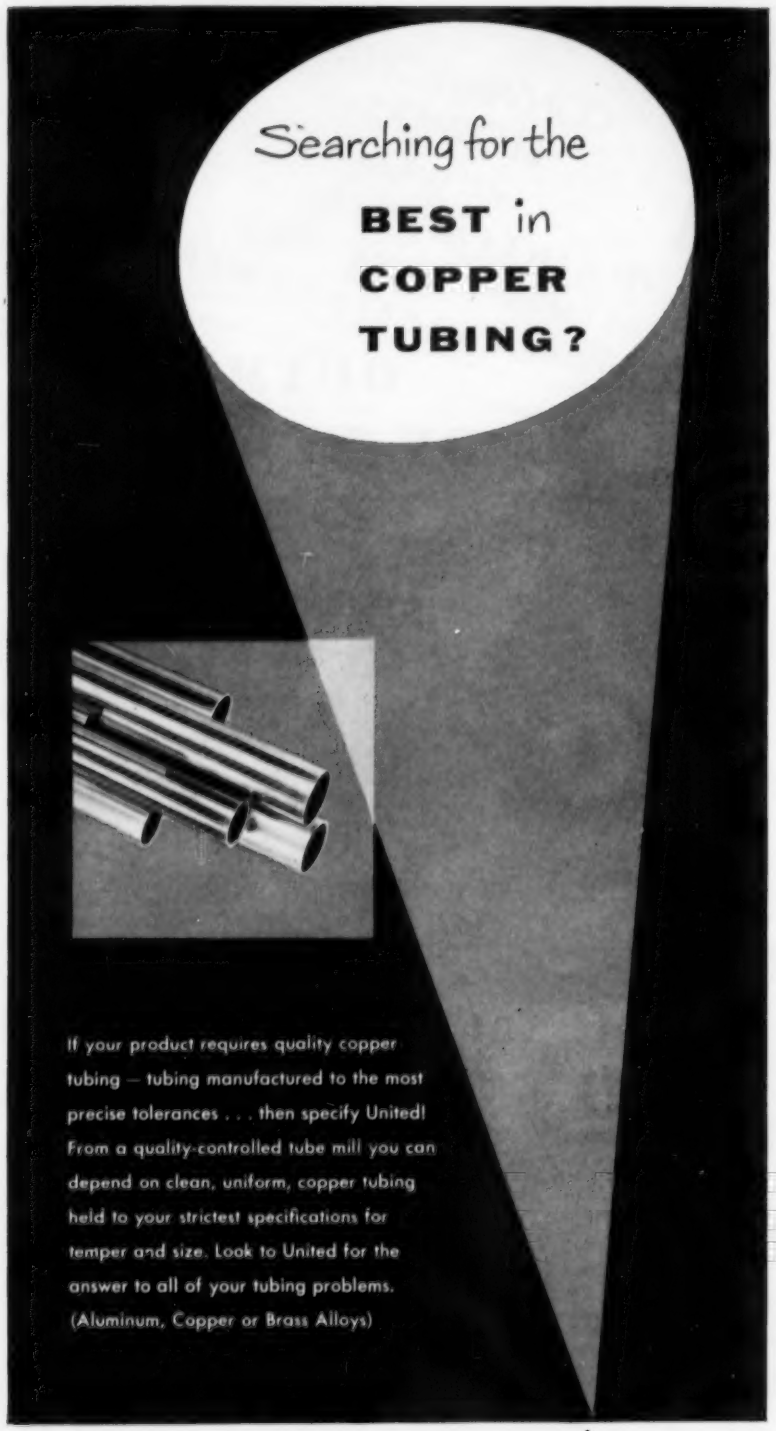
For trouble-free, long-life blowers, specify IPF blowers made of Unplasticized, Rigid Polyvinyl Chloride (UPPVC). UPPVC — the new construction material — exhibits inherent anti-corrosive qualities that allows IPF Blowers to withstand most chemical fumes and gases from 40°F to 140°F. Actual installations of IPF Blowers have lasted three times the normal life of ordinary blowers . . . and continue to function efficiently.

UPPVC is a lightweight . . . smooth surfaced . . . nonporous material of construction. Lightweight construction means greater capacity per B.H.P. . . . easier installation . . . reduced handling problems. Smooth, nonporous finish never require painting or maintenance expense. IPF Blowers are not subject to unbalance from chipping of a protective coating . . . because there is no coating. It's solid UPPVC.

IPF Blowers made of UPPVC are available in standard sizes that provide displacements from 143 C.F.M. to 7722 C.F.M. Standard wheel sizes of 9½, 13¾, 19, and 27 inches. Other sizes and capacities can be custom designed to fit special requirements. Full details on the new IPF Blowers available upon request.

Full details on the new IPF Blowers available on request.

MANUFACTURED BY
industrial plastic fabricators, inc.
NORWOOD, MASS. NOrwood 7-3411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TUBING?
If your product requires quality copper tubing — tubing manufactured to the most precise tolerances . . . then specify United! From a quality-controlled tube mill you can depend on clean, uniform, copper tubing held to your strictest specifications for temper and size. Look to United for the answer to all of your tubing problems. (Aluminum, Copper or Brass Alloys)
For brazing — United's Phoson brazes at the lowest practical brazing temperature, yet forms super strength joints.
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Providence 7, Rhode Island
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COPPER, BRASS AND ALUMINUM WIRE AND TUBING, AND BRAZING ALLOYS

RECENT TRADE LITERATURE

Continued

temperature of water or air as outdoor temperature changes. *Automatic Devices Co., Inc., Dept. HPAC,* 714 *Hillgrove Ave., Western Springs, Ill.*

▸ *WELDING* — "High Speed Welding of Steel Compressor Cases," a 12 page reprint, covers application of inert-gas metal arc welding to production of hermetic line of compressors for room air conditioners, refrigeration units. *Air Reduction Sales Co., Dept. HPAC,* 150 *E. 42nd St., New York* 17.

▸ *WELDING* — New 170 page welding data book features simplified welding procedures for every base metal. Covers 120 welding rods, electrodes, welding compounds. Data given on methods of gouging, chamfering, removing of unwanted metal without special equipment. Weld preparation steps given for all metals. How to get maximum machinability, how to get color matching deposits, how to increase weld strengths and cut down on amount of alloy used and finishing time and work also covered. *Eutectic Welding Alloys Corp., Dept. HPAC, Flushing* 58, *N.Y.*

▸ *WROUGHT IRON PIPE* — New 16 page booklet, "Wrought Iron Pipe for Modern Buildings," identifies wrought iron pipe, describes composition, advantages of metal. Included are sections on resistance to corrosion, fatigue stresses, weldability, forming and threading, application of protective coatings. Cost, availability also reviewed. *A. M. Byers Co., Dept. HPAC, P. O. Box* 1076, *Pittsburgh* 30.

▸ *WOUND ROTOR MOTORS* — Bulletin 51B8195A cites features, construction, applications of wound rotor motors designed for use where high starting torque with low starting current is needed. *Allis-Chalmers Mfg. Co., Dept. HPAC,* 1176 *S. 70th St., Milwaukee.* ≠

WHO'S WHAT...

(New personnel, promotions)

▸ *DODGE MFG. CORP.*—Carl W. Peterson, executive vice president; Earl Wedlake, vice president in charge of production and purchasing; Karl D. Jahnke, secretary and treasurer. Mr. Jahnke succeeds Temple Williams, who is retiring but remaining a director of the company and chairman of its finance committee.

▸ *YORK CORP.*—Todd L. Owens, manager, advertising and sales promotion; James M. Farrell, sales manager, room air conditioners.

▸ *WALWORTH CO.*—Robert Graves Hess, executive vice president.

▸ *INSTITUTE OF BOILER AND RADIATOR MANUFACTURERS*—Officers elected for 1956-57 are: E. R. Westphal of Weil-McLain Co., chairman; T. B. Focke of National-U. S. Radiator Corp., vice chairman; Robert E. Ferry, treasurer. New executive committee is composed of: Danial J. Quinn, American Radiator and Standard Sanitary Corp.; Virgil A. Good, Burnham Corp.; M. C. Reed, Dunkirk Radiator Co.; R. G. Pinkerton, Eastern Foundry Co.; T. L. Arnold, Fedders-Quigan Corp.; S. K. Smith, H. B. Smith Co.; Carl Sahler, Thatcher Furnace Co.; Gordon Bennett, Vulcan Radiator Corp.; Warren Webster, Jr., Warren Webster and Co. A representative of Crane Co. will be chosen at a later date as a member of the executive committee.

▸ *NEW YORK AIR BRAKE CO.*—Karl W. Galliger, director of engineering.

▸ *FRIGIDIARE DIV., GENERAL MOTORS CORP.*—C. H. Menge, general sales manager.

▸ *CRANE CO.*—J. W. Greene, director of industrial sales; W. A. Burbine, director of heating sales. Fred E. Akers, company's director of market research, has been elected president of Chicago chapter, American Marketing Association.

▸ *L. O. F GLASS FIBERS CO.*—Clinton F. Hegg, general sales manager. Mr. Hegg is vice president of the company.

▸ *RIDGE TOOL CO.*—William L. Parcell, vice president. He will serve as director of sales.

▸ *W-S FITTINGS DIV., H. K. PORTER CO., INC.*—Carl J. Sievert, sales manager.

HOW DOREX STOPPED THE TROUBLE A-BREWING

Scene: A famous Brewery. Neighboring plants include a copper mill, paint factory and paper mill—all contributing to a localized air pollution problem.

Problem: Beer flavor was being affected by polluted air. So much so that when the wind was in a certain direction, the brewery was forced to suspend operations—sometimes for days at a time.

Solution: Dorex Air Recovery was installed in the air conditioning system to purify air coming into the bottling room. This proved so successful that a second Dorex installation was made in the chilling room to prevent possible contamination at that point. *Dorex has completely eliminated shutdowns due to air pollution.*

If your operations require pure uncontaminated air, investigate Dorex Air Recovery. In addition to clearing up the immediate problem, Dorex can also substantially reduce costs of installing and operating an air conditioning and ventilating system. Write us for full information. Connor Engineering Corporation, Dept. A-86, Danbury, Connecticut.

CONNOR ENGINEERING CORPORATION

dorex® air recovery

WHO'S WHAT

Continued

▸ *DODGE MFG. CORP.*—Carlton Shamo, supervisor of publicity.

▸ *McDONNELL & MILLER, INC.*—Bill Gleeson, vice president. He is the company's sales promotion manager.

▸ *ZONOLITE CO.*—John B. Myers, president.

▸ *ALL-STATE WELDING ALLOYS CO., INC.*—Kenneth V. Lutz, vice president in charge of sales.

▸ *NELSON STUD WELDING DIV., GREGORY INDUSTRIES, INC.*—Richard E. McGinnis, manager of field sales; John S. Godley, marketing manager.

▸ *GOVERNAIR CORP.*—Patrick J. Shea, general sales manager.

▸ *RHEEM MFG. CO.*—Robert J. Pierson, Jr., national advertising and sales promotion manager of heating and plumbing and container divisions; D. W. Proulx, national product manager for water heaters, the post held by Mr. Pierson prior to his new assignment.

▸ *VIKING AIR PRODUCTS*—Engineers appointed to research and development staff are: John Palasics, William Page, Robert Allwein, L. D. Cochran, Robert Ross, Stanley Morse.

▸ *MICRO METALLIC CORP.*—Charles H. Hacker, assistant sales manager.

▸ *BALDWIN-HILL CO.*—J. L. Mohun, general sales manager, industrial insulation division.

▸ *NATIONAL MINERAL WOOL ASSOCIATION*—William A. O'Hara, secretary.

▸ *BORG-WARNER CORP.*—Col. Earl W. Haefner, assistant to the president of Borg-Warner International Corp.

▸ *BUSH MFG. CO.*—Lawrence E. Jennings, Jr., product manager.

▸ *THOR POWER TOOL CO.*—Frank J. Weitekamp, secretary.

▸ *REDMOND MOTOR CO.*—Robert E. Drury, vice president and assistant secretary.

SAVE WITH THESE STANDARD DESIGNS

Drawing on its long and varied experience in manufacturing heat exchangers, ADSCO has standardized the designs of many of its U-bend heaters and coolers. In this standardization program, production costs have been reduced, while the performance ability of the exchangers has been maintained. The result is high ADSCO value with the benefits of standardization passed along to customers.

TANK SUCTION HEATERS
Viscosity of heavy oils and other liquids is reduced by heating so they can be pumped economically. Only liquid to be pumped is heated, eliminating steam waste.

OIL PRE-HEATERS
Highest performance is obtained from fuel oil by heating it properly for complete combustion in burner. Work done by pre-heaters permits use of heavier grade, less costly fuel oil.

CONDENSATE COOLERS
As condensate coolers or waste-heat reclaimers, this equipment transfers otherwise wasted B.T.U.'s to other fluids which must be heated, thus effecting substantial savings.

STORAGE WATER HEATERS
Wide choice of tank materials offered, including solid or clad corrosion-resistant metals, or steel with phenolic resin lining. Of welded construction, in vertical or horizontal types. Removable heating elements of copper U-tubes.

INSTANTANEOUS WATER HEATERS AND CONVERTORS
For heating water for process work or for showers and washrooms. As convertors, these heaters are used for space heating. Of simple U-bend design with removable element.

ADSCO HEATERS AND COOLERS

AMERICAN DISTRICT STEAM DIVISION
ADSCO INDUSTRIES, INC.
20 MILBURN ST. BUFFALO 12, N. Y.

WHO'S WHAT

Continued

▸ *FISCHER & PORTER CO.*—Philip E. Sellers, sales vice president; Herman Kockritz, field sales manager; William Trethaway, district manager of Atlanta office.

▸ *TRENT TUBE CO.*—Howard J. Bowman, director of research and development.

▸ *PITTSBURGH PLATE GLASS CO.*—Orville Miller, Jr., manager of "superfine" products sales for company's Fiber Glass Div.

▸ *CARLIN CO.*—H. B. Hastings, Jr., field representative.

▸ *PITTSBURGH PIPE & COUPLING CO.*—William G. Miller, director of purchases and traffic.

▸ *ATLAS VALVE CO.*—Robert B. Davis, sales manager; Joseph E. Fachet, director of sales.

▸ *SHAW-PERKINS MFG. CO.*—Gene Gribble, in charge of research and development.

▸ *SCAIFE CO.*—Members of new sales management team for Timken Silent Automatic Heating and Cooling Div. are: C. E. Ford, vice president and assistant to the president; F. M. Jordan, general sales manager; R. E. Loebell, director of merchandising; S. T. Ramey, advertising manager; K. O. Ralphs, sales manager.

▸ *BENDIX AVIATION CORP.*—Vernon D. Hauck, assistant general manager of Friez Div.

▸ *ELLIOTT CO.*—Promotions in Crocker-Wheeler motor division are: Philip Scarola, sales manager; Charles R. Steen, manager of engineering.

▸ *CARRIER CORP.*—Ralph C. Wilgus, traffic manager; Arnold B. White, coordinator of engineering standards; John W. Newton, national publicity representative; Elbridge F. Rauscher, manager of new products and their development for allied products division.

▸ *CARLON PRODUCTS CORP.*—T. W. Dunn, vice president and general sales manager.

▸ *PENNSYLVANIA SALT MFG. CO.*—David S. Tillotson and Peter Pawlyk, added to staff of company's technical division and assigned to its sales-services department under direction of William P. Lee.

Pabst

protects warehouse from condensation with a

MT. HAWLEY

BOILER - BURNER!

With its usual care and thorough planning, Pabst Brewing Company made sure that the Peoria warehouse, where 6,000,000 unfilled beer cans and stacks of cartons are stored, would be free from excess humidity. They took every precaution to make sure that their cans and cartons were protected against moisture penetration.

Safety against moisture was insured by a Mt. Hawley A-300S Boiler Burner (Oil input: 10 gph . . . steam output: 3,000 sq. ft.). Four overhead steam heaters circulated warmed air throughout the 20,000 sq. ft. warehouse.

Mt. Hawley's complete line of compact boiler-burner units cover a range of capacities from 80,000 to 740,000 btu/hr. To defeat a specific problem or to provide efficient, dependable heat for a home or building, Mt. Hawley's the answer.

Write, wire or phone Peoria 2-5448 collect for free literature and prices, at no obligation: Do it today!

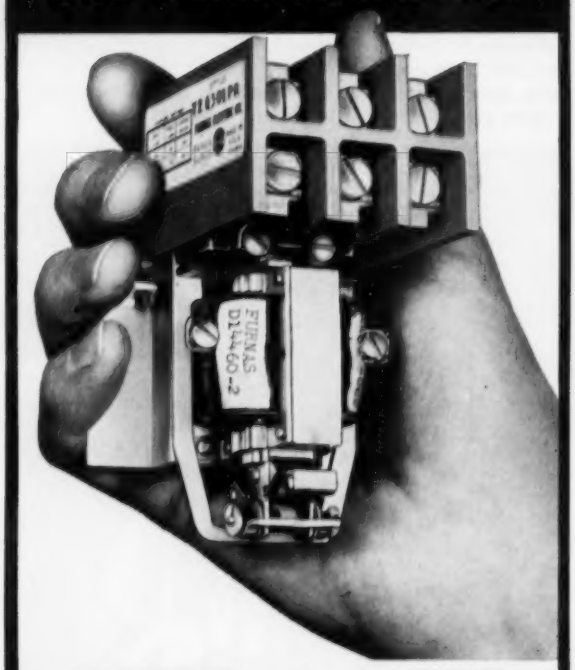
MT. HAWLEY FULLY AUTOMATIC OIL BURNERS—A size for any heating need. Efficient . . . long-lived . . . compact . . . silent

MT. HAWLEY MFG. CO.

Dept. H-8 Routes 174 & 88 Peoria, Illinois

FURNAS ELECTRIC CONTROLS

do the best job for AIR CONDITIONING and REFRIGERATION



NEW—4 SIZES

For the first time, an ampere size to match your single and polyphase starter requirements for current rated motors through 550 volts. Now you can choose from 20-30-35-50 ampere sizes. Look for these features: 1—Each pole carries full current—no poles connected in parallel. 2—Silver Cadmium Oxide contacts—longer life. 3—Magnets require less watts thereby reducing transformer sizes and thermostat contact load—savings in cost and space.

WRITE TODAY FOR BULLETIN 5610—1041 McKEE STREET, BATAVIA, ILLINOIS

A7

FURNAS ELECTRIC COMPANY

BATAVIA, ILLINOIS

Sales Representatives in all Principal Cities

WHO'S WHAT

Continued

▸ *SUNDSTRAND ENGINEERING CO.*—Charles B. Bendix, executive vice president.

▸ *GENERAL ELECTRIC CO.*—Appointment within distribution assemblies department is: John S. Macdonald, general manager.

▸ *PHILIP CAREY MFG. CO.*—R. F. Turner, sales promotion manager; N. D. Musser, assistant merchandising manager of building products department.

▸ *CUTLER-HAMMER, INC.*—W. F. Lent, vice president in charge of manufacturing; R. A. Millermaster, vice president in charge of development.

▸ *FEDDERS-QUIGAN CORP.*—Thomas H. Ford, assistant to the vice president.

▸ *A. M. BYERS CO.*—H. Kenneth Siefers, Jr., added to company's engineering service department.

IN THE TERRITORIES . . .

(Recent sales appointments)

▸ *YOUNGSTOWN SHEET AND TUBE CO.*—R. P. Broadhurst, district sales manager, Chicago; C. Hix Jones succeeds Frank D. Carroll as district manager at Dallas.

▸ *CRANE CO.*—Thomas D. Kelly and Darrell R. Nordwall, managers of company's midwest and east coast districts, respectively; Harold L. Goll, manager of new branch at Harrisburg, Pa.; Ralph A. Lamsey, assistant manager of Boston branch; John T. Beamer, assistant to the manager of eastern district; William A. Kopcho, assistant manager of Washington branch; William C. Frazier, manager of branch at Corpus Christi, Tex.; Frank B. Chappell, branch manager at Ft. Smith, Ark.; A. J. Norre, special representative servicing industrial accounts and reporting to Chicago general office; Bruce Bain, accounting supervisor at Chicago regional sales office; Robert J. McMillan, office manager of Detroit branch.

▸ *WHEELCO INSTRUMENTS DIV., BARBER-COLMAN CO.*—William Thorrat, manager of newly established Houston branch office; Harold S. Hern, assigned to sales-service staff at Baltimore; John C. Twomey, sales engineer at Boston; Walter A. White and Robert G. Steel, Chicago sales engineers; Tom J. Chakos, added to Chicago sales organization; Henry T. Clinkaberry and Robert D. Getzelman, service engineers at Los Angeles office; Charles E. McGoff, St. Louis service engineer.

"WITCH"

PIPE HANGERS

FOR

HEATING – PLUMBING POWER & PROCESS

- LOW COST
- FULL LATERAL ADJUSTMENT
- DESIGNED FOR THICK OR THIN SLAB
- ONE BODY SIZE WITH REMOVABLE NUT

FIG. 75
CONCRETE
INSERT

Our catalogue illustrates a complete line of Pipe Hangers & Supports and is an indispensable reference book for engineers, contractors, estimators & erectors. Write for your copy now.

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CARPENTER and PATERSON, Inc.

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NO BLASTS

NO COLD CORNERS

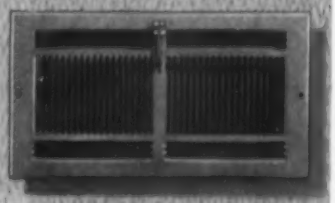
NO HOT SPOTS

. . . just pure comfort!

WITH STANDARD'S NO. 551 PERIMETER WALL REGISTERS

Air is diffused 4-ways, along the outer cold walls, providing complete 360° hemispheric heating or cooling.
New fractionator volume control,
standard screw holes,
single shutter control, smart appearance,
for sidewall or baseboard installation.
See for yourself why Standard's 551 is the best perimeter wall register on the market!

MAIL THE COUPON FOR FREE LITERATURE.



STANDARD STAMPING & PERFORATING COMPANY
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Gentlemen: Please send me literature on the Standard No. 551 Perimeter Wall Register.

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COMPANY_____
ADDRESS_____
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Custom Made
AIR DIFFUSERS
with
DIFFUSING VANES
Each AGITAIR square and rectangular air diffuser is custom designed to meet your requirements of air flow and interior treatment.
These AGITAIR diffusers have built-in diffusing vanes, scientifically arranged in unlimited louver patterns to provide certified 100% draftless air distribution from any ceiling or wall location.
AGITAIR Catalog R-107 shows you how to select the proper size and pattern for your job conditions.
Write for your copy today.
you can depend on AGITAIR for better air
AIR DEVICES INC.
185 MADISON AVE., N. Y. 16, N. Y.
air diffusers • filters • exhausters

WHO'S WHAT

Continued

▸ *BLACK & DECKER MFG. CO.*—Joseph E. Watson, service manager of new factory sales and service branch at Harrisburg, Pa.

▸ *CENTURY ELECTRIC CO.*—Gunar Moe, district manager for New York office; John B. Heil, acting district manager at Birmingham.

▸ *CHAIN BELT CO.*—Kenneth G. Gunderson, district sales engineer.

▸ *FISHER GOVERNOR CO.*—J. G. Chilcoat and Co., representative for western Pennsylvania, West Virginia.

▸ *RODGERS ENGINEERING CO., INC.*—has moved to 1925 Record Crossing Rd., Dallas.

▸ *OVERHEAD HEATERS, INC.*—Herbert F. Robinson, New England district manager.

▸ *UNITED STATES AIR CONDITIONING CORP.*—National Plumbing & Heating Supply Corp., distributor for Rhode Island.

▸ *STEWART-WARNER CORP.*—Gus Wolf, regional sales manager of Winkler air conditioning and heating equipment.

▸ *McQUAY, INC.*—Vernon Tupper, Jr., factory representative for central Tennessee.

▸ *THOR POWER TOOL CO.*— E. C. O'Connell, manager of new Kansas City branch.

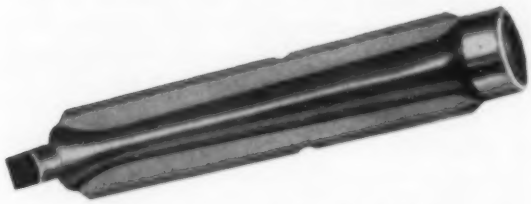
▸ *ORANGEBURG MFG. CO., INC.*—Carl Franklin Arnold, north central district sales manager to cover the Dakotas, Nebraska, Kansas, Missouri.

▸ *BINKS MFG. CO.*—James Dacey, representative for Syracuse area. George Sherwood, who is Buffalo representative, has moved to 477 Elmwood Ave., there.

▸ *EDWARD VALVES, INC.*—Clyde Sheffield, sales engineer for southeastern Texas.

▸ *DRAVO CORP.*—Snell Refrigeration Supply Co., distributor for 53 county area in Texas.

Webster
provides quality plus in the
WEBSTER KINETIC®



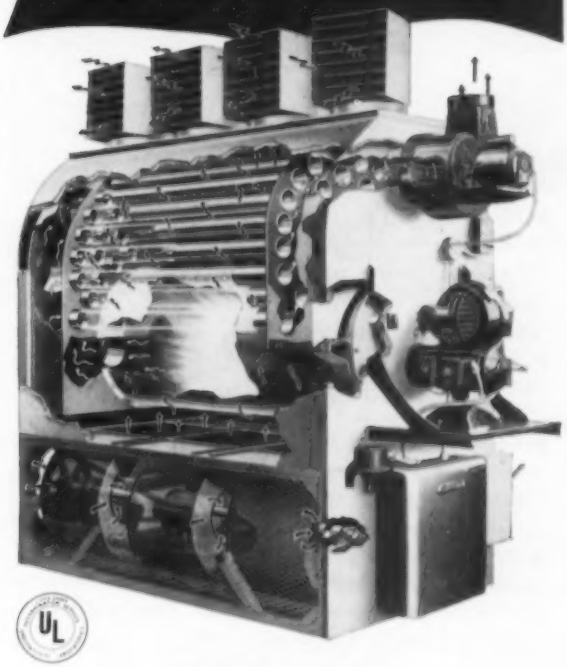
At no increase in cost to you, the Venturi tube and flame retention nozzle unit of the famous WEBSTER KINETIC® now is fabricated from steel. Longer life and smoother operation is assured from a lighter weight unit.

The heavy gauge chrome alloy nozzle is also standardized on the ROTONETIC and HC DYNETIC units.

This is just another example of Webster's ability to engineer and manufacture a more efficient and economical "tool" for burning gas. In its class no other commercial or industrial burner can compare cost wise with quality.

The
WEBSTER ENGINEERING *Company*
TULSA 1, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

Commercial-Aire

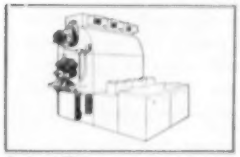


DIRECT-FIRED

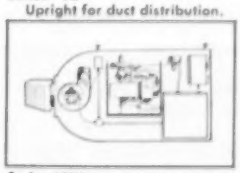
Space Heaters

300,000 BTU's
TO 2,000,000 BTU's

Provides industry with lowest cost heating. Primary cylindrical stainless steel combustion chamber, secondary heat-extracting tubes, consistent rate of combustion gas flow provide high efficiency, utilizing 80% of available heat of fuel. Highly adaptable to desired mounting arrangements. Features low first cost, easy maintenance, complete accessibility to all service points. Completely equipped and wired with controls for economical installation.

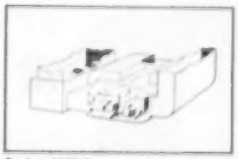


Series "FD"
Upright for duct distribution.



Series "H"
Horizontally suspended.

Series "U"
Inverted suspended.



Series "HD"
Horizontally for duct distribution.

MAMMOTH FURNACE CO.
6425 Cambridge St.
Minneapolis, Minn.
Send full details, prices, delivery dates, etc., on Commercial-Aire Heaters.

NAME_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

WHO'S WHAT

Continued

▸ *AUTOMATIC SWITCH CO.*—New Hampshire Supply Co. and R. B. Dunning and Co., stocking distributors of solenoid valves for Manchester, N. H., and Bangor, Me., respectively.

▸ *ARMCO STEEL CORP.*—Willard Danner, manager of eastern sales; Sidney Yager, Chicago district sales manager.

▸ *BUSH MFG. CO.*—Robert T. Thorpe and Alvin S. Vener, sales engineers to cover north Boston, New Hampshire, Maine area, and San Antonio area, respectively.

▸ *YORK CORP.*— George I. Kalish, zone sales supervisor for north Atlantic district.

▸ *CHASE BRASS & COPPER CO.*—Paul M. Thomas, midwestern regional manager; Alfred M. Johnson, Dallas district manager, succeeding Mr. Thomas.

▸ *AIRTEMP DIV., CHRYSLER CORP.*—Raymond L. Griggs, field engineer for Columbus, O., district; C. J. Otis, builder contact, Chicago; Gordon Dronen, added to Chicago region sales staff.

▸ *DIEHL MFG. CO.*—Rowland Guildford, fan merchandising specialist in New York City area.

▸ *PENNSYLVANIA SALT MFG. CO.*—Allan H. Lee, added to technical sales staff of Pennsalt Chemicals of Canada.

▸ *KENNARD CORP.*—W. L. Lashley & Assoc., representative in Houston, surrounding trading area.

▸ *K S M PRODUCTS, INC.*— M. L. Sundeen, district engineer covering Michigan, Ohio, Indiana for company's stud welding division; H. J. Redding, to supervise, service stud welding accounts in northern Illinois, Wisconsin, Minnesota, northern Michigan.

▸ *JACKES-EVANS MFG. CO.*—Harry F. Zuba, field engineer for controls division in northern New Jersey, New York, New England.

▸ *PHILIP CAREY MFG. CO.*—Robert D. Williams, Indianapolis district manager; C. E. Morgan, assistant manager of Cincinnati district.

▸ *MAID-O'-MIST, INC.*—Louis Schneider & Co., representative for Indiana. ⧺

FOR FLEXIBLE CONNECTIONS IN

● DUST COLLECTION ● FUME CONTROL
● AIR-CONDITIONING ● MATERIALS HANDLING

PORTOVENT® ◂◂◂ USE ▸▸▸ FLEXAUST®

Spiral wire reinforced
DUCT

Sizes 3" to 36" ID Wide Pitch type RETRACTABLE

Flexaust hoses and Portovent ducts are made with strong cotton or nylon fabrics, impregnated and coated with neoprene compounds. Seams are fully bonded. Other important features are—

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- AIRTIGHT — STRONG
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- VERY EASY TO HANDLE AND INSTALL

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Spiral wire reinforced
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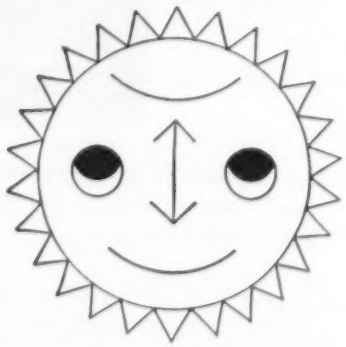
Sizes 1¼" to 36" ID Close pitch type

WRITE TODAY FOR

Bulletin #40 — General information
Bulletin #41 — Accessories and Installation Data
Bulletin #42 — Technical data on products and service.
Bulletin #43 — Application data and type selector guide.
Bulletin #44 — Friction loss data.
Prices lists.

THE FLEXAUST COMPANY, Dept. HP-8
100 PARK AVENUE NEW YORK 17, NEW YORK

The tragic fact, our doctors tell us, is that every third cancer death is a needless death... *twice* as many could be saved.



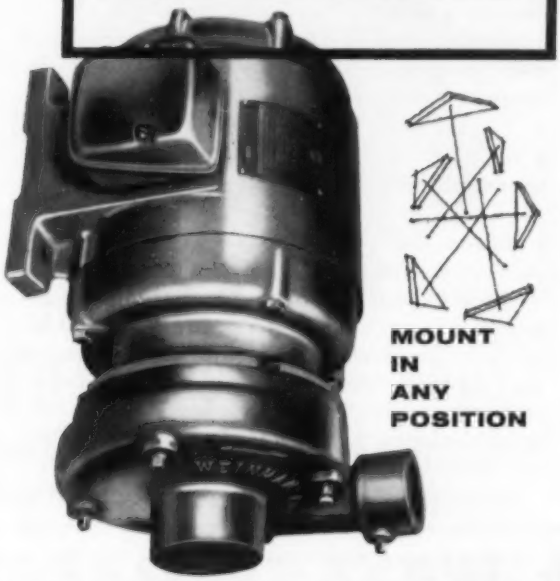
LET'S LOOK AT THE BRIGHTER SIDE

Many thousands of Americans are cured of cancer every year. More and more people are going to their doctors *in time*...To learn how to head off cancer, call the American Cancer Society or write to "Cancer" in care of your local Post Office.

American Cancer Society

BIGGER NEWER

WEINMAN
AC UNIPUMPS



MOUNT IN ANY POSITION

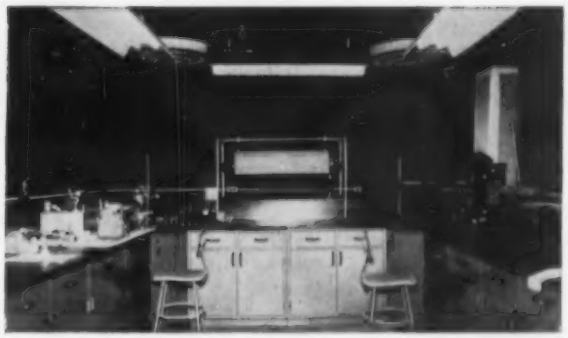
A real space saver, WEINMAN Close-Coupled Type AC Centrifugal Pumps can be mounted in any desired position . . . on the floor, the ceiling or on a wall . . . with the shaft horizontal, vertical or at an angle. A rotary type mechanical shaft seal, a ceramic floating seal seat and a carbon compound sealing washer assure longer life and leakless operation in any mounted position, even when handling water containing abrasive dust such as may be collected when water passes over a cooling tower.

No matter how specialized your need for a circulating pump, you'll find the pump you need in WEINMAN'S bigger line of AC pumps. The recent addition of the new 6 AC and 8 AC models to the standard WEINMAN AC Line make this popular unit available with higher capacities, a wider choice of larger motors, and a greater variety of sizes than ever before.

WEINMAN Type AC Centrifugal Pumps are preferred by engineers the nation over for air conditioning systems, cooling tower circulation, hot and chilled water circulation, booster service and other general pumping needs. Write for free literature.

If you have an immediate pump problem, call your nearest WEINMAN CENTRIFUGAL PUMP SPECIALIST. He's listed in the yellow pages of your phone book.

THE **WEINMAN PUMP** MFG. CO.
290 SPRUCE ST. COLUMBUS 8, OHIO



You Can Have DRY Air with EXACT Moisture Control

for your comfort, for your process, for testing machines or materials at any time of the year

Niagara Air Conditioning provides you with any temperature and relative humidity you need, held constant or varied at will. Using "Hygrol" absorbent, you save the refrigeration commonly used to condense moisture and make reheat unnecessary in most cases. It gives large capacity with compact, easily-maintained equipment.

This Niagara Air Conditioning Method dries air directly and measurably, using a moisture-absorbing liquid spray. Humidity control is a separate function from heating or cooling.

This gives you precise control over your air conditions with thermostats alone; no moisture-sensitive devices are needed. You have simpler, more trustworthy, less expensive control instrumentation. Niagara precise-control air conditioning installations have the best record for reliability.

Write for information on the application to your problem. Ask for descriptive Bulletins #112 and #121. Address Dept. HP

NIAGARA BLOWER COMPANY

405 Lexington Ave. New York 17, N. Y.

District Engineers in Principal Cities of U. S. and Canada

WE HEAR THAT . . .

▸ Stockholders of *BUSH MFG. CO.* and *C. A. DUNHAM CO.* have approved decisively the consolidation of the two companies for the formation of a new company to be known as *DUNHAM-BUSH, INC.*

▸ *NATIONAL-U.S. RADIATOR CORP.* and *UNION ASBESTOS & RUBBER CO.* have announced jointly an agreement transferring the Union Asbestos air conditioning division to National-U. S. Radiator. In announcing the acquisition, *THEODORE B. FOCKE*, president of National-U.S., stated that the move was a further step in the direction of broadening that company's activities in the fields of heating and summer cooling. The principal acquisition in the transfer is a manufacturing plant in Greenville, Ill.

▸ *SCHEMENAUER MFG. CORP.* has purchased the patents and physical assets of *RECOY PRODUCTS CO.* Recoy will be operated at Holland, Ohio, as a division of Schemenauer.

▸ *A. W. CASH CO.* has opened new offices at Decatur, Ill. Former office space in that city has been converted to manufacturing facilities.

▸ *UNITED STATES AIR CONDITIONING CORP.* has moved its main offices and plant from Minneapolis to Philadelphia. The Philadelphia operations have been established in the plant acquired by the company when it purchased *JORDON REFRIGERATOR CO., INC.*, now a subsidiary. With the transfer, the Minneapolis plant, occupied since 1946, has been closed.

▸ Officials of *CRANE CO.* and *REPUBLIC STEEL CORP.* have announced that the two companies have become equal partners in *CRAMET, INC.* Cramet was formerly a wholly owned subsidiary of Crane. Four representatives of each of the parent companies will make up the board of directors of Cramet, which will remain a separate corporation.

▸ *SOCIETY OF THE PLASTICS INDUSTRY, INC.* has moved to new offices at 250 Park Ave., New York.

▸ Construction of a highly specialized testing laboratory for the *INSTITUTE OF BOILER AND RADIATOR MANUFACTURERS* is expected to be underway shortly at Urbana, Ill. The purpose of the lab will be to provide check tests on baseboard and finned tube radiation where I=B=R ratings are involved, supplementing original tests conducted by the individual producers. According to I=B=R, the facility will involve expenditures of about $75,000.

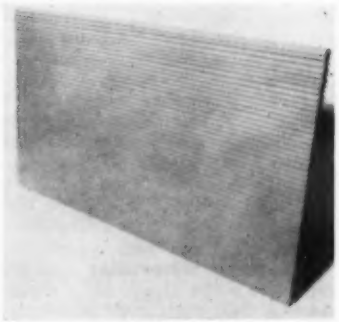
What's NEW with WATERLOO??

I. **NO-SITE CORE, for thin door panels and partitions.**

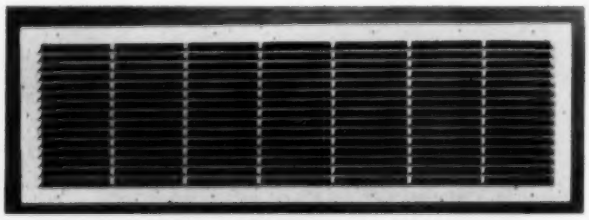
II. **HEAVY DUTY RETURN AIR GRILLE, to withstand rugged usage in schools and industrial buildings.**

Thin Core and Heavy Duty—certainly two opposites in the Grille field, but each serving a definite need in its respective usage.

These additions to the WATERLOO line of Grilles, Registers, Volume Control Dampers and Door Ventilators further demonstrates WATERLOO'S endeavor to supply a COMPLETE assortment of Air Diffusion Equipment for the Sheet Metal Contractor.



NO-SITE CORE



HEAVY DUTY RETURN AIR GRILLE

More reasons why WATERLOO is consistently specified by leading Architects and Engineers for schools, hospitals, churches, government, office and industrial buildings, commercial structures and homes.

Write for Literature on these Items, or for the complete WATERLOO Catalog

WATERLOO REGISTER CO., Inc.

P. O. BOX 72 **WATERLOO, IOWA**

NEW FUEL PUMP UNIT Cuts Costs Two Ways

Install TUTHILL TYPE SU V-BELT Pumping Unit for Lower Original Cost and Reduced Maintenance

The new Tuthill Type SU multiple V-belt pumping units provide structural and performance advantages that save money and insure dependable, uninterrupted operation.

Features like these make the SU outstanding for handling heavy fuel oils in industrial and commercial heating:

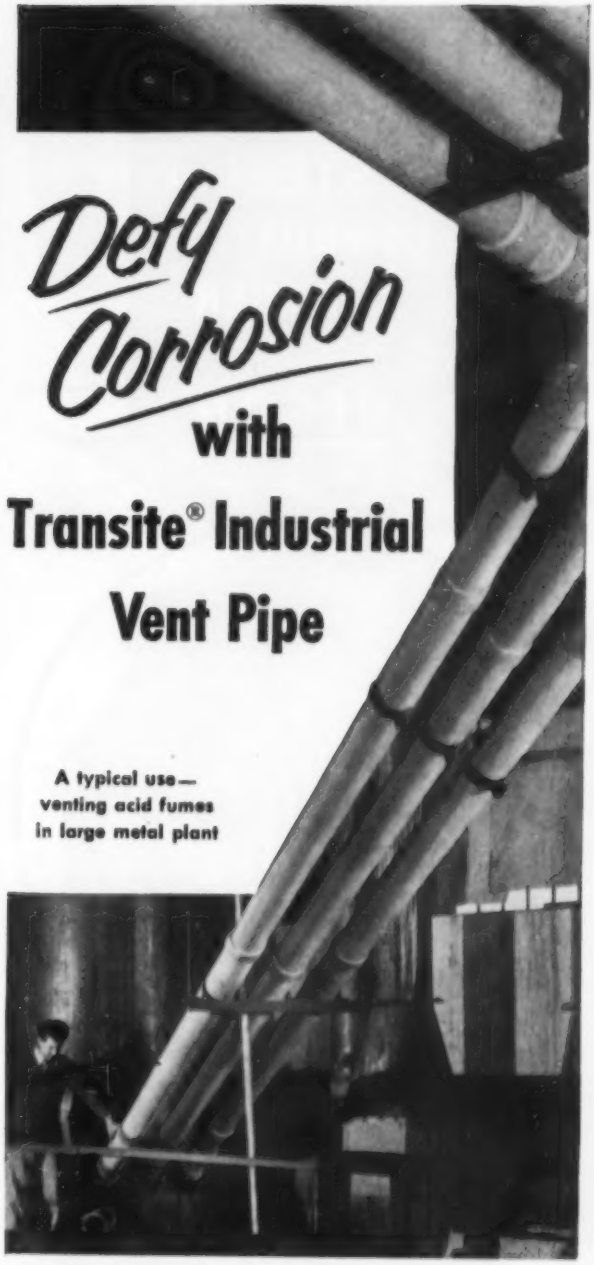
- ★ **Double savings through low original cost and low maintenance cost.**
- ★ **One-point belt-tension adjustment.**
- ★ **Motor mounting provides for motors up to 7½ h.p.**
- ★ **Fabricated steel base with all bolts and adjustments readily accessible.**
- ★ **Handles 2 to 4 belts as required.**
- ★ **Standard pulleys for economy and prompt replaceability.**
- ★ **Pump, jack shaft and pillow blocks available as separate unit.**
- ★ **Wide range of capacities and pump models featuring lip-type shaft seal especially designed to eliminate leakage in handling heavy fuel oils.**

Write for new Bulletin No. 107

TUTHILL PUMP COMPANY
Dependable Rotary Pumps . . . since 1927
939 East 95th Street, Chicago 19, Illinois

Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd.
Ingersoll, Ontario, Canada

Defy Corrosion with Transite® Industrial Vent Pipe



A typical use—venting acid fumes in large metal plant

IN SEVERE VENTING SERVICES, Transite's outstanding performance is a matter of record. Made of asbestos and cement, two of nature's most indestructible materials, it resists the attack of most fumes, vapors, and dusts.

Installed indoors or out, Transite Industrial Vent Pipe can't rust or rot, never needs paint, nor other protective coating. Wide variety of fittings makes it adaptable to any layout. For more information, write Johns-Manville, Box 14, New York 16, N.Y. In Canada, Port Credit, Ontario.

Johns-Manville
TRANSITE INDUSTRIAL VENT PIPE
An Asbestos-Cement Product

STAINLESS STEEL COMBUSTION CHAMBER OF THE OLSON

MOST ADVANCED HEATER

The combustion chamber of an Olson is constructed of Austinetic Stainless Steel. Its floating design eliminates undue expansion and contraction stresses. Note the secondary heat transfer surface above, a multiple battery of 10 guage boiler tubes separated by stainless steel baffles providing a four pass counterflow gas travel. The extended flue gas travel and extra heat transfer surface insures high efficiency and safe metal temperatures and long dependable heater life. Write for complete information on Olson Heaters.

Olson

STAINLESS STEEL DIRECT FIRED HEATERS

Gas—Oil—Dual Gas and Oil—300,000 to 2,000,000 BTU

CANFIELD, OHIO

REPRESENTATIVES IN PRINCIPAL CITIES

WE HEAR THAT

Continued

▸ The organization meeting of the supervisory board of directors of *YORK DIV.* of *BORG-WARNER CORP.* was held recently and the following directors and officers were elected:

Roy C. Ingersoll, chairman of the supervisory board; S. E. Lauer, president and chief executive officer. Mr. Ingersoll is chairman and chief executive officer of Borg-Warner.

The balance of the board of directors is composed of: R. S. Ingersoll, president of Borg-Warner; H. M. Haase, assistant to the president, in charge of engineering, research and development for Borg-Warner; R. W. Murphy, vice president and general counsel and vice chairman of the executive committee of Borg-Warner; L. G. Porter, executive vice president of Borg-Warner; Albert Steg, financial vice president and treasurer of Borg-Warner; R. F. Lauer, vice president in charge of engineering and research and assistant to the president of York; J. K. Louden, vice president and general manager, commercial division of York; R. K. Serfass, vice president and general manager, industrial division of York; and C. W. Fenninger and William J. Meinel, former members of the York board.

Former officers of York Corp. reelected were: vice presidents A. C. Freimann, J. M. L. Joslin, D. M. Magor, M. G. Munce; secretary and treasurer, W. F. Lynne. Also, R. H. Dowling was elected assistant vice president to R. F. Lauer; C. A. Barnes, assistant secretary and assistant treasurer and C. W. Fenninger, Jr., assistant secretary.

The board then took action to form a new company, *YORK CORP., A SUBSIDIARY OF BORG-WARNER*, which will perform and be responsible for all factory and field sales operations for the York Div.

The same board of directors and officer group were elected by York Corp. to control and administer its operations.

▸ The formation of *THERMO-FLEX CORP.* to distribute glass fiber and allied products nationally has been announced by *R. W. CAPAUL*, president of the new firm. General offices and warehouse will be located at 1202 Norwood Ave., Toledo.

▸ *BALLINGER CO.*, architects and engineers, has moved to new offices at 1625 Race St., Philadelphia 3.

▸ *INSTO-GAS CORP.* has moved its general offices and main plant to larger facilities at 998 E. Woodbridge Ave., Detroit.

▸ Construction by *CARRIER CORP.* of a new administration and research center is underway at Syracuse. The facility is the major project in the company's $12 million expansion program there.

▸ *JOSEPH T. RYERSON & SON, INC.* held an open house at its Chicago plant recently for customers,

☆ ☆ ☆

Manufacturers' Agents

Are you interested in securing additional lines?

We are occasionally asked by our manufacturer advertisers to suggest the names of manufacturers' agents in various sections of the country whom they can contact in regard to representation of their industrial and large building heating, piping, and air conditioning products.

If you would like your name listed on our records for inquiries we may receive on your territory, we invite you to write us. There is no charge in connection with this service.

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In the Fairmac Corporation Housing Development near Washington, D.C., replacement of existing "controls" with Walker "BB" Draft Regulators reduced fuel consumption in two boiler houses to such an extent that the cash savings actually paid for complete installation of all 85 Walker draft units! These fuel savings were accomplished in only *three months time*—and they were so spectacular that the April, 1953 issue of *Fueloil & Oilheat* devoted its lead article to a report of the complete details of the story! Reprints of this article are available upon request.

Walker "BB" Industrial Draft Controls can bring you the same kind of savings that the Fairmac Corporation is enjoying. Find out how by reading Walker's "Handbook of Draft Control for Industrial Installations." It gives the most complete facts ever assembled on control selection, proper location, capacities, installation and adjustment. This valuable handbook is absolutely free — and your request for a copy puts you under no obligation. Reserve your copy now — just send coupon below to:

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Gentlemen: I want the complete story on how Walker "BB" Industrial Draft Controls can cut my fuel costs. Please send me your free handbook on "Draft Control for Industrial Installations." I'm considering draft control installations on:

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- School ☐
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- Laundry ☐
- Garage ☐
- Other _____

WE HEAR THAT

Continued

suppliers and employees and neighbors and their families. About 12,000 attended. According to the caterers, who served refreshments and dinner, this was the largest undertaking of its kind ever attempted by a company in the Chicago area.

▸ Twenty six representatives from air conditioning and refrigeration firms in Germany, Austria, Switzerland, The Netherlands and Sweden participated in a tour of *MARLO COIL CO.'s* plants in St. Louis, recently.

▸ *COPELAND REFRIGERATION CORP.* will shortly embark on an expansion program designed to add nearly 500,000 sq ft of manufacturing and administrative space to the company's present facilities. Construction will be on a 75 acre site at the western limits of Sidney, Ohio.

▸ An expansion program for the Evansville division of *WHIRLPOOL-SEEGER CORP.*, which will cost in excess of $19 million this year, began recently with work on a 90,000 sq ft addition to the existing 962,000 sq ft plant acquired last year. The addition is scheduled for occupancy by mid-September.

▸ *GENERAL CONTROLS CO.* held an open house recently in a new building at 600 Bryant St., San Francisco. The structure is said to increase the company's facilities there by 120 percent.

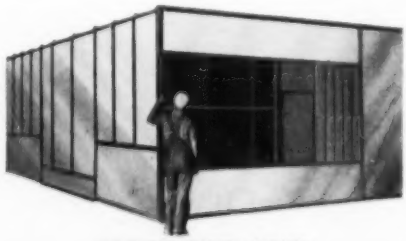
▸ Technical and informational activities of the *MAGNESIA INSULATION MANUFACTURERS ASSOCIATION* have been expanded to cover two additional types of thermal insulation for high temperature service. These are calcium silicate and expanded silica. Association interests now embrace the two newer products as well as 85 percent magnesia and diatomaceous silica insulations. Calcium silicate insulations are for use up to 1200 F and the expanded silica insulation to 1600 F.

▸ Construction of two new plants for the production of low pressure polyethylene has been reported by *UNION CARBIDE AND CARBON CORP.* The structures, with a combined rated annual capacity of 55 million lb, are scheduled for completion next year.

▸ In a joint statement by *JOSEPH T. RYERSON & SON, INC.* and *REYNOLDS METALS CO.*, it was announced that Ryerson would sell Reynolds aluminum throughout the areas served by the former's Chicago and Milwaukee plants. ⁜

SPRAY AIR WASHER
SINGLE AND TWO BANK DESIGNS AVAILABLE IN A WIDE RANGE OF SIZES. FACTORY INSULATED CONSTRUCTION ILLUSTRATED

CAPILLARY AIR WASHER
CLASS I (CONCURRENT) SHOWN. CONSTRUCTED FOR 1000 TO 160,000 CFM THESE WASHERS OFFER PATENTED FEATURES FOR HIGHEST EFFICIENCY



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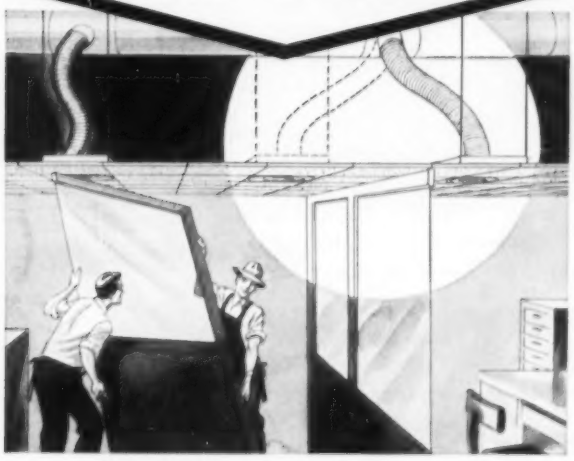

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...make more profit on the job

Not only is Wiremold Flexible Air Duct *easier* and *faster* for air conditioning installations, it is also *most practical* in modular ceiling installations . . . especially when subdividing and re-partitioning office space. Wiremold Air Duct's *extreme* flexibility makes diffuser relocation possible without disconnecting the duct work.

Wiremold Air Duct is manufactured to very close tolerances—fits snugly on the diffuser outlet. Short lengths can be spliced on the job—saves on waste material.

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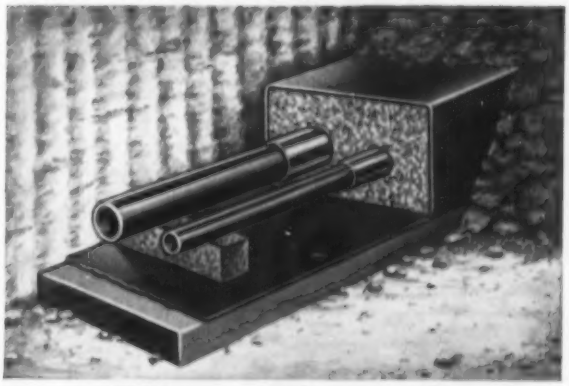
The ORIGINAL Molded Cast-in-Place Monolithic Concrete Conduit for UNDERGROUND HOT PIPES



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through 15 years of service ...hundreds of miles of conduit trouble-free!

The *first* load-bearing insulation to support, protect and insulate underground hot pipes...*was Z-Crete*. And today, Z-Crete installations are still performing at top efficiency, because permanent Z-Crete actually increases in efficiency as time passes. Z-Crete was first to provide necessary structural protection against ground movements and loads! Investigate this superior conduit that pours in place faster, at low cost. Z-Crete is sold and installed only by licensed applicators of Zonolite Company under U.S. Patent No. 2355966—Canadian Patent No. 439356.

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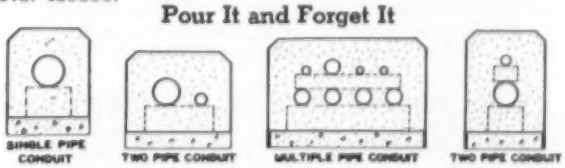

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MEETINGS & CONVENTIONS

SEPT. 10-12—*American Society of Mechanical Engineers*, fall meeting. Denver. ASME headquarters: 29 W. 39th St., New York 18.

SEPT. 17-21—*11th Annual Instrument-Automation Conference and Exhibit.* Coliseum, Columbia University, and Hotels Statler and New Yorker, New York. Sponsored by Instrument Society of America. Exhibit office: 250 W. 57th St., New York 19.

SEPT. 24-28—*Trade Fair of the Atomic Industry.* Navy Pier, Chicago. Conference headquarters is Morrison Hotel, Chicago. Information: D. J. Scherer, Atomic Industrial Forum, Inc., 260 Madison Ave., New York 16.

SEPT. 25-26—*Producers' Council, Inc.*, 35th annual fall meeting and chapter presidents' conference. Wade Park Manor Hotel, Cleveland. Information: Producers' Council, Inc., 2029 K St., N.W., Washington 6, D.C.

SEPT. 25-27—*Third Annual Forum Conference*, "Management and Technology for the Atomic Industry." Morrison Hotel, Chicago. Information: D. J. Scherer, Atomic Industrial Forum, Inc., 260 Madison Ave., New York 16.

OCT. 1-3—*Mechanical Contractors Association of America*, fall board of directors meeting and secretaries' conference. Hotel Statler, Detroit. Headquarters: 30 Rockefeller Plaza, New York 20.

OCT. 1-3—*12th annual National Electronics Conference.* Hotel Sherman, Chicago. Information: J. S. Powers, executive secretary, National Electronics Conference, 84 E. Randolph St., Chicago 1.

OCT. 1-5—*National Association of Corrosion Engineers*, south central regional meeting. San Antonio. NACE headquarters: 1061 M&M Bldg., Houston 2.

OCT. 8-12—*American Welding Society*, fall technical meeting. Hotel Cleveland, Cleveland. Headquarters: 33 W. 39th St., New York 18.

OCT. 15-17—*American Gas Association*, annual convention. Atlantic City. AGA headquarters: 420 Lexington Ave., New York 17.

OCT. 15-17—*National Association of Corrosion Engineers*, northeast regional meeting. Drake Hotel,

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Monarch Brass F-80 Air Conditioning Nozzles (or ¼" male one-piece H-261 style) produce the finest possible breakup of small capacities with low direct pressure only. No air required.

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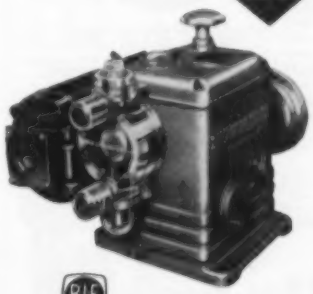

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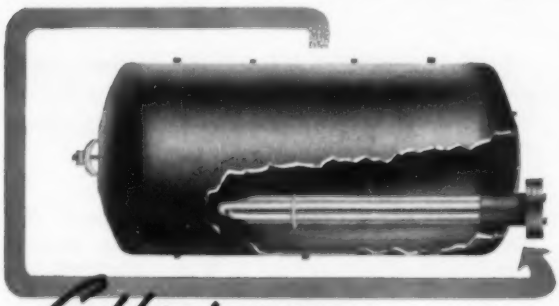

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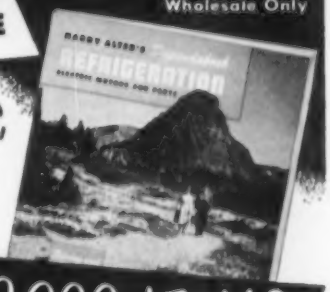

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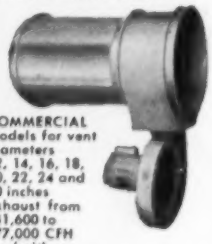

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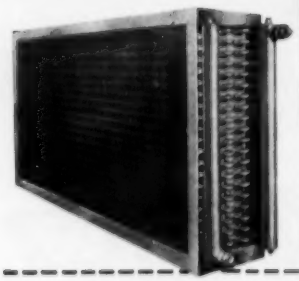

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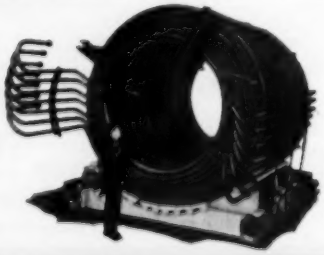

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MEETINGS & CONVENTIONS — *Continued*

Philadelphia. NACE headquarters: 1061 M&M Bldg., Houston 2.

OCT. 22-24—*American Standards Association*, 38th annual meeting in conjunction with Seventh National Conference on Standards. Hotel Roosevelt, New York, N. Y. Headquarters: 70 E. 45th St., New York N.Y.

OCT. 22-26—*44th National Safety Congress & Exposition.* Chicago. National Safety Council, 425 N. Michigan Ave., Chicago 11.

OCT. 23-26—*National Association of Corrosion Engineers*, south central regional meeting. Gunter Hotel, San Antonio. NACE headquarters: 1061 M&M Bldg., Houston 2.

OCT. 24-27—*Air-Conditioning and Refrigeration Wholesalers*, annual meeting. Jung Hotel, New Orleans. Headquarters: 2607 N. High St., Columbus, Ohio.

OCT. 29-*NOV.* 2—*National Association of Practical Refrigerating Engineers, Inc.*, annual convention. Statler Hotel, Detroit. Headquarters: 435 N. Waller Ave., Chicago 44.

NOV. 15-16—*National Association of Corrosion Engineers*, north central regional meeting. Hotel Statler, Detroit. NACE headquarters: 1061 M&M Bldg., Houston 2.

NOV. 15-18—*Refrigeration Service Engineers Society*, annual convention Hotel Muehlbach, Kansas City, Mo. Headquarters: 433 N. Waller Ave., Chicago.

NOV. 25-28—*American Society of Refrigerating Engineers*, semi-annual meeting. Boston. Information: ASRE, 234 Fifth Ave., New York 1.

NOV. 25-30—*American Society of Mechanical Engineers*, annual meeting. Statler Hotel, New York. ASME headquarters: 29 W. 39th St., New York 1.

NOV. 26-28—*Refrigeration and Air Conditioning Contractors Association*, annual convention. Balmoral Hotel, Miami Beach. RACCA headquarters: 10660 Carnegie Avenue, Cleveland 6.

NOV. 26-30—*22nd National Exposition of Power and Mechanical Engineering.* Coliseum, New York. Under auspices of American Society of Mechanical

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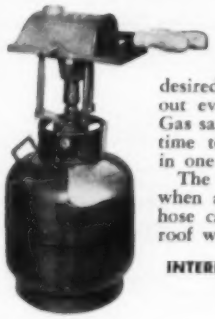

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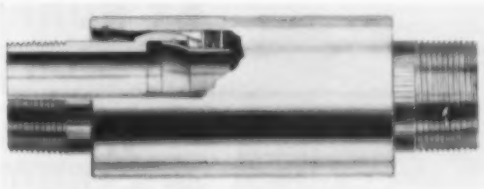

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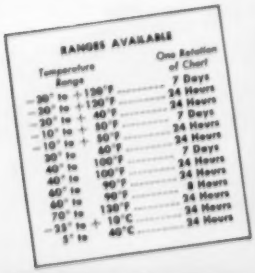

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−10° to + 50°F	7 Days
−10° to + 50°F	24 Hours
30° to 60°F	24 Hours
40° to 100°F	7 Days
40° to 100°F	24 Hours
60° to 90°F	24 Hours
60° to 90°F	8 Hours
60° to 130°F	24 Hours
70° to 130°F	24 Hours
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MEETINGS & CONVENTIONS *Continued*

Engineers. Manager: E. K. Stevens, care of the Exposition, 480 Lexington Ave., New York 17.

NOV. 26-30—*Third International Automation Exposition.* Trade Show Bldg., New York. Management: Richard Rimbach Assoc., Inc., 845 Ridge Ave., Pittsburgh 12.

NOV. 26-30—*National Warm Air Heating and Air Conditioning Association,* committee meetings and annual convention. Netherland Plaza, Cincinnati. NWAHACA headquarters, 640 Engineers Bldg., Cleveland.

1957

JAN. 28-31—*Eighth National Plant Maintenance & Engineering Show.* Public Auditorium, Cleveland. Information: Clapp & Poliak Inc., 341 Madison Ave., New York 17.

FEB. 25-*MAR.* 1—*International Heating & Air-Conditioning Exposition.* International Amphitheater, Chicago. Under auspices of American Society of Heating and Air-Conditioning Engineers, in conjunction with its 63rd annual meeting, also at Chicago. Exposition management: International Exposition Co., 480 Lexington Ave., New York 17. ASHAE headquarters: 62 Worth St., New York 13.

MAY 6-8—*Air-Conditioning and Refrigeration Institute,* annual meeting. The Homestead, Hot Springs, Va. ARI headquarters: 1346 Connecticut Ave., N.W., Washington 6, D.C.

MAY 7-10—*Mechanical Contractors Association of America,* annual meeting. Hotel Fontainebleau, Miami Beach. The association is at 30 Rockefeller Plaza, New York 20.

JUNE 2-5—*American Society of Refrigerating Engineers,* annual meeting. Hotel Fontainebleau, Miami Beach. ASRE headquarters: 234 Fifth Ave., New York.

JUNE 24-27—*American Society of Heating and Air-Conditioning Engineers, Inc.,* semi-annual meeting. Murray Bay, Quebec. Information: A. V. Hutchinson, executive secretary, ASHAE, 62 Worth St., New York 13.

NOV. 18-21—*10th Exposition of the Air-Conditioning and Refrigeration Industry.* Navy Pier, Chicago. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D. C. ⋕

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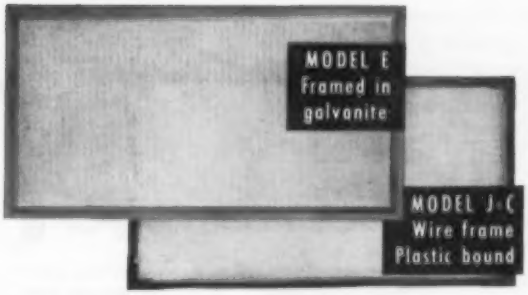

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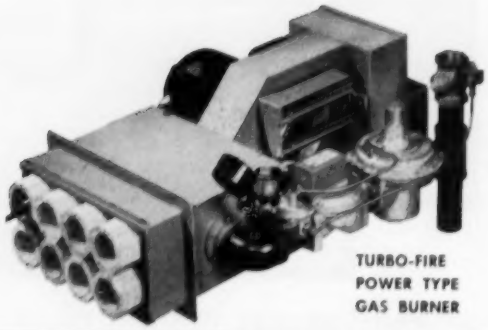

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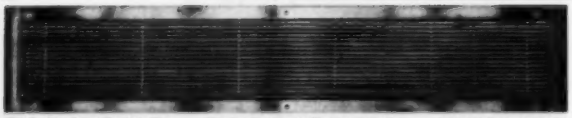

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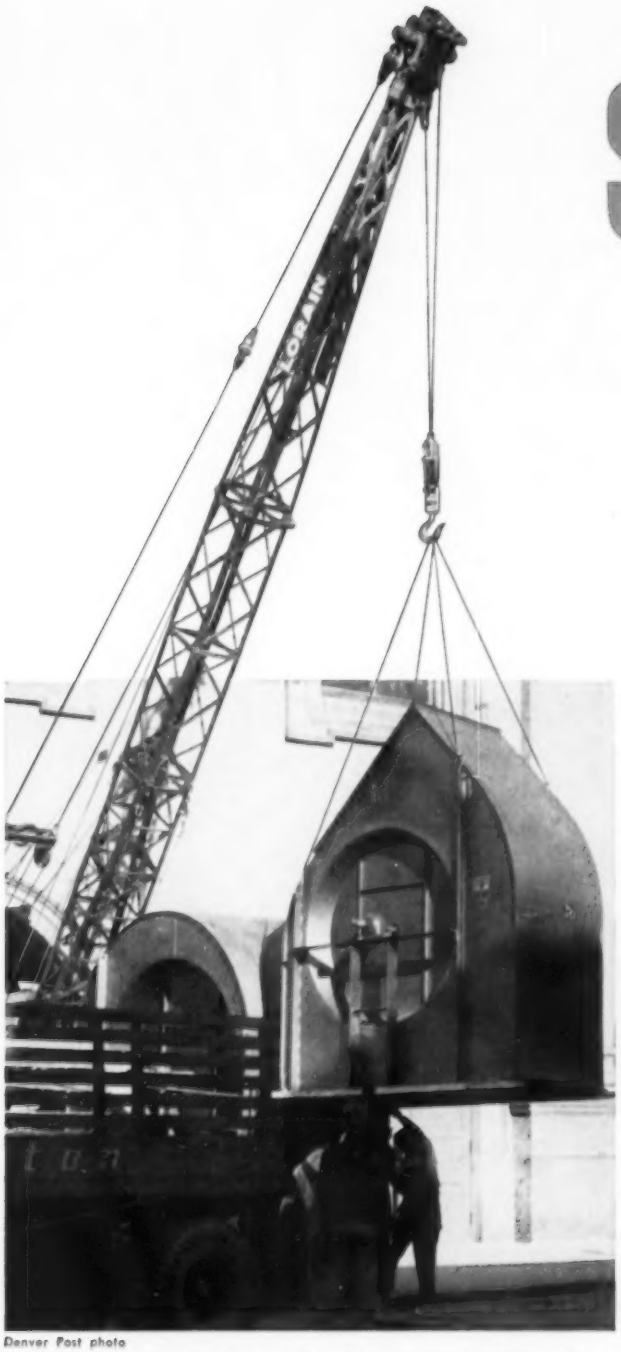

Denver Post photo

Owner: City of Denver. **Architect:** G. Meredith Musick. **General Contractor:** Mead & Mount Construction Company. **Heating, Ventilating and Air Conditioning Contractor:** Troutman & Shreve, Inc. **Structural Engineer:** Phillips-Carter-Osborne, Inc.

SETTING THE STAGE

for a Better Breathing Denver Auditorium

Another ventilating assignment for Clarage. One of the features of the remodeled Denver City Auditorium is a new "respiratory system" using these Clarage Type HV Fans and a Clarage Type V Air Washer.

Here, as in so many other notable buildings the nation over, Clarage equipment was chosen for its recognized ability. Quiet . . . economical . . . and, most assuredly, dependable.

Make sure *your* investment in air handling and conditioning is a profitable one. Investigate the equipment we have perfected for every type of application. CLARAGE FAN COMPANY, Kalamazoo, Michigan.

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. . . dependable equipment for making air your servant

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

yes

McDONNELL Controls for boilers up to 250 psi!

KNOW THIS 92 SERIES

In Four Models that meet all conditions

Here is the real answer to water level control for boilers up to 250 psi—the McDonnell 92 series providing pump control, low water fuel cut-off, and low water alarm.

This control has exactly what it takes for high pressure and temperature. Notice, for example, the generous float chamber with wide clearances between float and walls.

Keeping heat away from the switch mechanism is a foremost requirement in a control of this kind. In the 92 series an ingenious heat barrier, tapered neck, and fins, combine to effect an unprecedented heat dissipation—well proved by the fact that the 92 series complies with *current* underwriters' specification for 75°C wiring at switch terminals.

The 92 series combines a more effective use of magnetic switch actuation with McDonnell-built open contact switches—switches that do not call for the accurate alignment of the control that is necessary with other types.

There are too many features of the 92 series to cover here, but the whole story can be told in three words: *McDonnell quality throughout!* Note how the 92 series is built for you in four forms to fit right in to any boiler job requirement.

State your conditions. Let us help you select the right 92 series control for your job. Ask for complete engineering folder on 92 series installations, and wiring sheets.

McDONNELL & MILLER, *Inc.*
3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

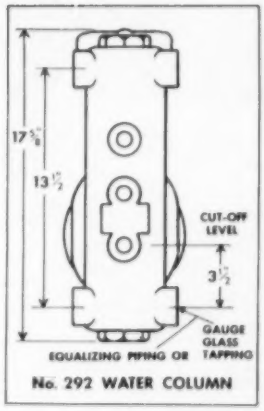
What the 92 series does—The 92 series does three basic jobs, singly or in combination: **(1)** controls boiler feed pump *from* the boiler—exactly as it should be controlled for maximum efficiency **(2)** provides a low water fuel cut-off—cuts current to burner in the event of a low water emergency **(3)** closes circuit for operating low water alarm whenever low water occurs. Series 92 controls are also adaptable to a wide range of industrial liquid level control applications involving pressures up to 250 psi. Upper switch includes extra circuit to gain 3 wire operator for motor operated valves.

Your Jobber Stocks Them

The Adaptable Water Column Form

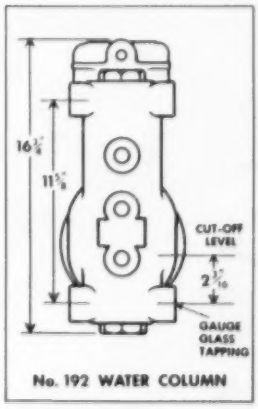
There are two 92 series controls with self-contained, water-column bodies having tappings for water-glass and tri-cocks. Water-column form simplifies installation, provides correct equalization, cuts costs and assures a trim, workmanlike job. Tappings provide for mounting control on either side of the boiler with gauge glass mounted on either side of control. The two 92 series water-column types are:

1 **No. 292** Principle dimensions shown in drawing. Note cut-off level is 3½" above center of lower gauge glass tapping. This taller body with higher cut-off point assures water level being plainly visible when located high on a big boiler. Control may be installed with either top and bottom or side equalizing connections. Gauge glass tappings may be reduced to either ¼" or ½"; tri-cock tappings, ½"; equalizing tappings, 1¼" top and bottom, or 1" side.



No. 292 WATER COLUMN

2 **No. 192** Dimensions opposite. Body is shorter, cut-off level lower than in 292, ideal for most fire-tube boilers. Both gauge glass and tri-cock tappings are ½"; equalizing tappings, 1¼".



No. 192 WATER COLUMN

Without Water Column

These two controls have the same basic operating mechanism as 192 and 292, but are designed for installation with independent water column.

3 **No. 92** Has 1¼" top and bottom equalizing tappings.

4 **No. 92A** Has two additional 1¼" side tappings for use where equalizing piping takes this form.

No. 92

No. 92A

McDONNELL *Boiler Water Level Controls*